AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 4, No. 26. WEEKLY. | NEW YORK, JUNE 25, 1881. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

COPYRIGHT, 1881, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

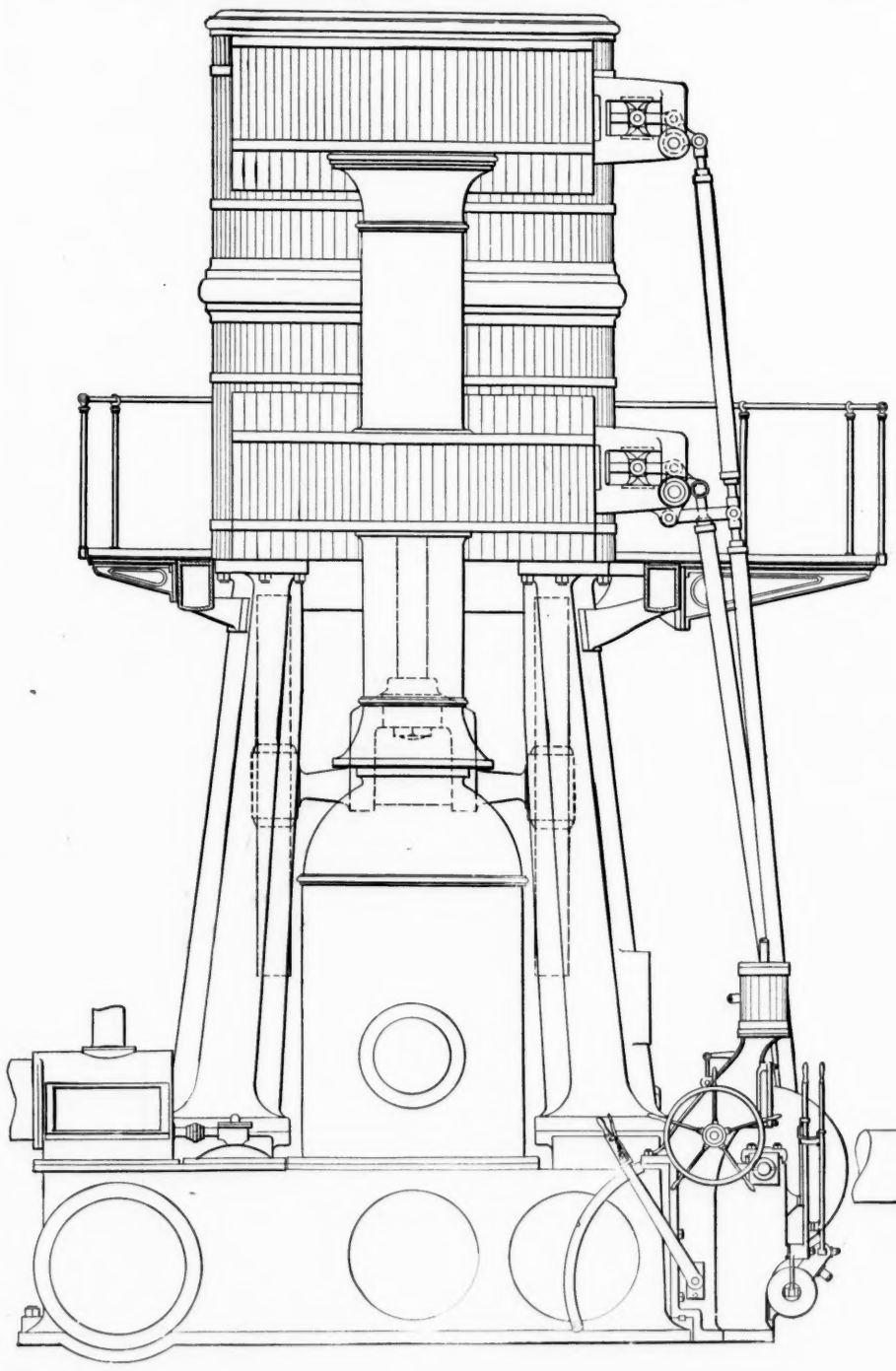


FIG. 3.—END ELEVATION OF LOW PRESSURE ENGINE, SUPERIOR

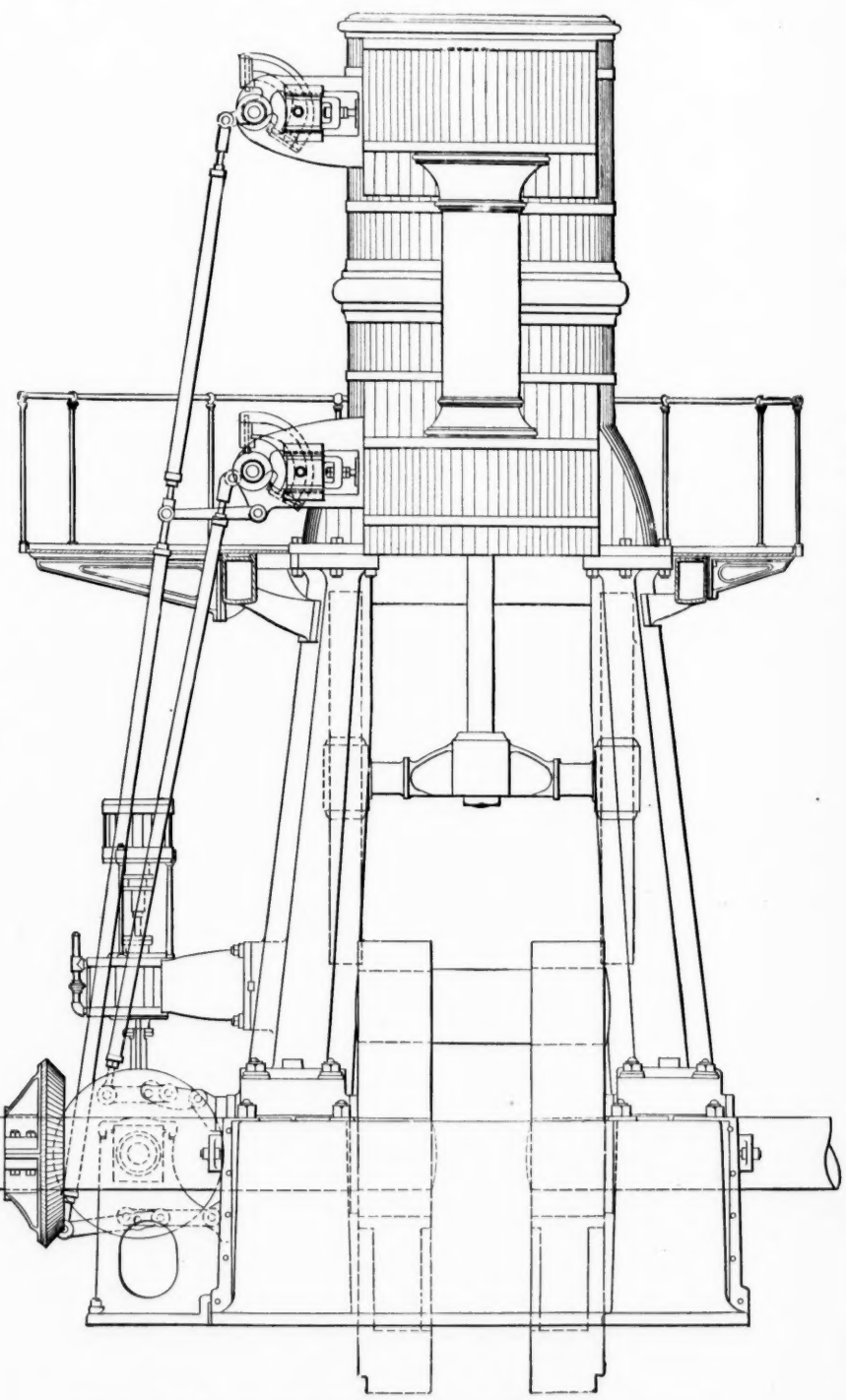


FIG. 2.—END ELEVATION OF HIGH PRESSURE ENGINE, SUPERIOR.

The Superior.

BY E. D. LEAVITT, JR.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The subject of the following paper is, The Compound Hoisting Engine, now building by the I. P. Morris Co., of Philadelphia, for the Calumet & Hecla Mine.

It is the fourth engine of its kind ordered by the Calumet & Hecla Mining Co., for whom the design was first specially made in 1874, and by reason of greatly exceeding its predecessors in size and power, it has been named the "Superior."

A brief history and description of this type of engine may be of interest.

Engine No. 1 was built in 1874 for pumping the water required by the separating and dressing machinery at the Company's Stamp Mills, which are situated at Lake Linden, Michigan.

It was an outcome and departure from the Lynn pumping engine, the arrangement of cylinders with their outer ends placed near together, and their pistons connected to opposite ends of a beam, being retained, together with the valve gear.

The departure from the Lynn engine consisted in inverting the cylinders, placing the beam below them, with its journals carried in pedestals on the main bed plate, and so constructing the beam that the connection from it to the crank was situated above and between the piston connections. The position of the shaft was by this means brought very nearly in the same horizontal plane as the main beam center, its distance from the same being a little greater than the length of the connecting rod.

Two pumps were used in this engine, one being located at each end of the beam, and both were hung to and below the bed plate. The latter consisted of a pair of deep hollow girders, placed parallel with each other and bolted at their ends to heavy foundation piers. This arrangement afforded excellent facilities for getting at the pumps.

It should be stated that this No. 1 engine had its low pressure cylinder placed vertically, and its high pressure cylinder at an angle of about 15° from vertical. One pump was situated in the same center line with the low pressure cylinder, thus allowing the steam and water pistons to be rigidly connected. The pump at the high pressure end of the beam was also vertical and worked by a trunk connection from the beam.

Although the first engine was built with the intention and expectation that it would have a large surplus capacity, the additions to the works were so large before it was put in operation that it had to start at a speed greater by twenty-five per cent. than its intended maximum, and before it had run one year this speed was nearly doubled.

The great demand for water at the Stamp Mills, and the success of the first engine in supplying it, decided the authorities of the Calumet & Hecla Co. to build a second pumping engine in 1876, of more than twice the nominal capacity of the first, and a third engine to be used for hoisting and general machinery driving at the Hecla Mine.

The second engine was very like its pre-

decessor, save in the construction of the pumps. The latter were fitted with differential plungers in lieu of buckets and plungers, and the change has proved a good one.

The No. 2 pumping engine was put in regular service early in December, 1876, and has run constantly 144 hours per week since that date, save on weeks having legal holidays, and one entire week when it was laid off to test the pumps of the No. 1 engine after they had been fitted with improved valves.

During the period of its operation it has made forty million revolutions and raised approximately thirteen thousand million gallons of water against a dynamic head of fifty-one feet.

It has neither required nor received any repairs.

The dimensions of the No. 2 pumping engine's cylinders are 17½ and 36 inches diameter by 5 ft. stroke, and of the pumps, 20 and 28 $\frac{5}{16}$ inches diameter of plungers, by 5 ft. stroke. The usual speed is 24 revolutions per minute.

The third engine was erected at the Hecla Mine in the fall and winter of 1876 and 1877, and started early in 1877. It is employed to drive four hoisting drums, each 24 ft. diameter, and weighing 70 tons, also a pair of 28"x48" air compressors, the rock breakers, and other mine machinery.

Its load is exceedingly variable, running from flying light to 650 H. P. The cylinders were originally 18 and 36 inches diameter by 5 ft. stroke; but for the purpose of increasing the power of the engine, two new cylinders have recently been made, having diameters of 22¾ and 38 inches.

The Hecla Hoisting Engine makes 48 revolutions per minute, and runs 20 hours per diem.

The extreme variability of the load was considered a condition directly opposed to a first-class economy, and the constructor's guarantee was four pounds of Brier Hill coal per H. P. per hour, the coal to be of such quality as should evaporate 7 $\frac{74}{100}$ lbs. of water per lb. of coal from and at 212°. On a trial of five days in May 1877, the coal averaged 3½ lbs. per horse power per hour, and the evaporation 7 $\frac{48}{100}$ lbs. of water per lb. of coal from and at 212°.

During a trial extending from Dec. 21st, 1880, to Jan. 1st, 1881, the consumption of coal was found to be 2 $\frac{13}{100}$ lbs., and of feed water, 16 $\frac{3}{10}$ lbs. per horse power per hour. The power during the latter averaged more than double the average exhibited on the preceding trial.

In 1878 a design was commenced for an engine of 1,500 horse power, to be located at the Calumet Mine. Before the drawings were completed, it was deemed judicious to increase the size of the engine to 2,500 horse-power, and a contract for the same was entered into in the fall of 1879. This engine is shown in the engravings upon pages 1 and 2.

In designing this engine, the economical advantages of "high pressure" and high piston speed were carefully taken into consideration; 135 lbs. per square inch was adopted for the former, and 720 ft. per minute for the latter.

As the load when the engine is first put in service will be, on the average, but about one-fourth of its rated power, extra precautions have been taken to provide against losses due to internal radiation. To accomplish this, the cylinders have been thoroughly steam jacketed on sides and ends, and the exhaust from the high pressure cylinder is passed through chambers filled with small brass tubes, through which steam of boiler pressure circulates.

There are two of these chambers (which are called re-heaters) placed between the cylinders, one at either end, and each contains about 700 square feet of heating surface. The arrangement is shown in the side elevation of the engine. (See Figs. 1 and 4.)

The "Superior" has both high pressure and low pressure cylinders placed vertically, the distance between centers being 9 feet. The diameter of the high pressure is 40 inches, and of the low pressure 70 inches. Each has 6 feet stroke of piston, and the speed will be 60 revolutions per minute.

The reheaters that connect the cylinders are oblong chambers in their transverse and vertical dimensions (see Figs. 5 and 6). Each contains 941 brass tubes, ⅝" diameter, and 60 inches long. The live steam is inside, and the exhaust outside these tubes; by the use of diaphragms all the tube surface is made efficient.

The distribution of steam is effected by

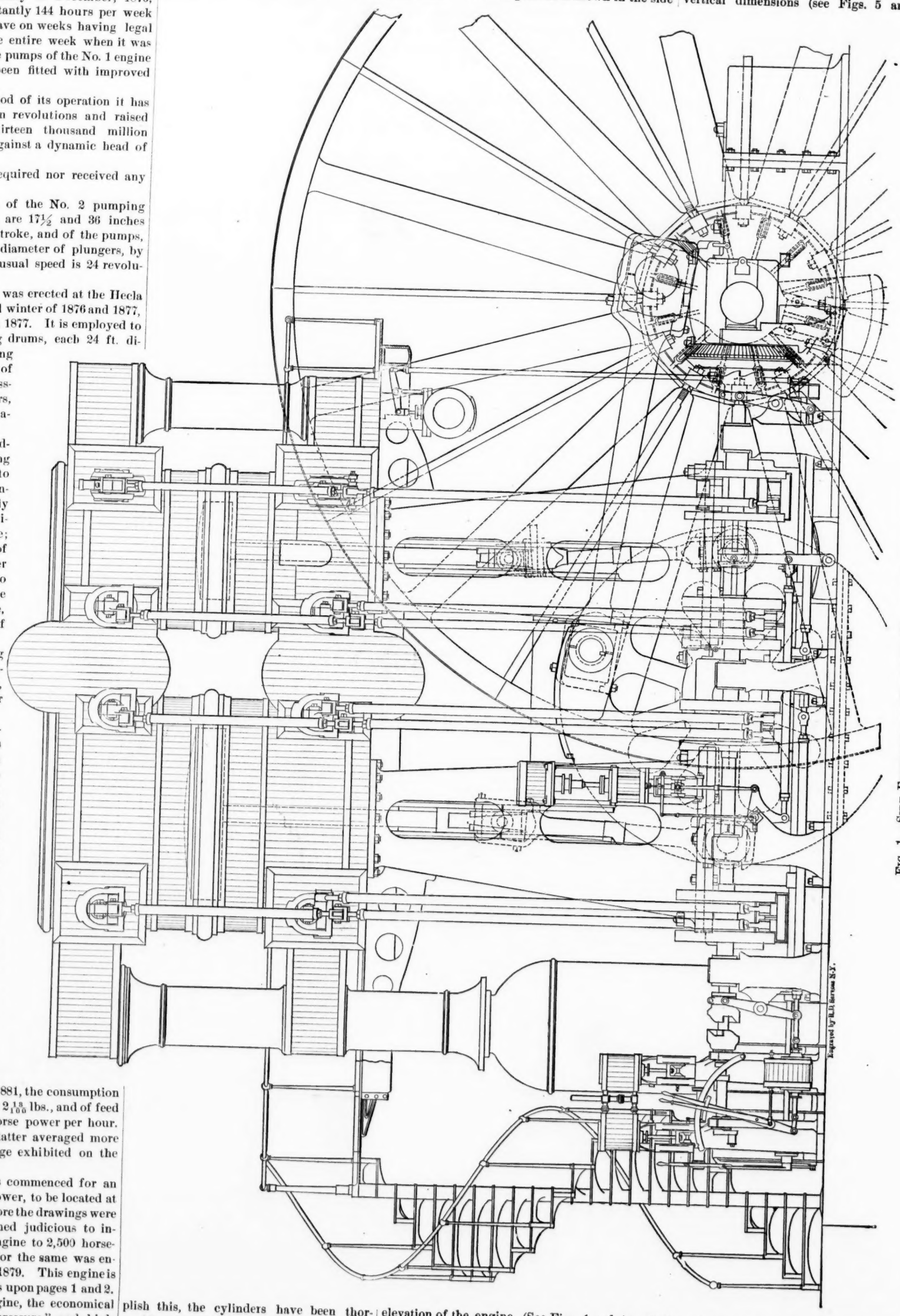


FIG. 1.—SIDE ELEVATION OF COMPOUND HOISTING ENGINE, SUPERIOR.

gridiron slide valves (see Fig. 7), which have a short horizontal travel. There are four valves for each cylinder, each being actuated by a separate grooved cam, so that its movements can be independently controlled and adjusted.

The valve gear consists of eight grooved cams fixed on a revolving shaft, which is driven by miter gears from the main crank shaft. (See Figs. 1, 2 and 3.)

The cam shaft is carried in bracket bearings, which are secured to the side of the main bedplate, and in addition have feet which rest upon the engine foundation.

The cams give motion to levers, which in turn communicate it to the bell cranks that move the valves. The connections between the levers and bell cranks are tubular.

The cam levers are made of Chester cast steel; their pins and rollers are of hardened open hearth steel. The throws of the cams are also of hardened steel, as shown on the full-sized drawing (exhibited.)

The cut-off is effected by the high pressure inlet valves, and is automatically controlled by the governor. The range is from 0 to $\frac{6}{10}$ the stroke. This is accomplished by making the cam in two parts, one for opening and the other for closing the valves. The opening part is made fast to the cam shaft, while the closing part is driven through a sleeve, which has a key slot running its entire length. The shaft inside the sleeve has a spiral key way, and a key is fitted to it and to the slot. This key is also made fast to a sliding collar, which embraces the sleeve, and is capable of being moved back and forth by a yoke and lever. The lever receives its motion from the piston of a small steam cylinder, the valve of which is operated by the governor in such a manner that the position of the piston is definitely fixed by the position of the governor balls. Abundant power for moving the collar is thus provided, in combination with a very delicate and sensitive Porter governor to determine where and how far it shall be used.

The cam just described operates two independent compound levers, one being required for each high pressure inlet valve. The compound levers are so constructed that one part has a fixed pivot at one end, and a roll fitting the opening cam at the other. At the middle of its length there is a stud, to which the other part of the lever is pivoted. This lever is provided with a roll that fits the movable or closing cam, which is situated about one-third of its total length from the pivoted end. The outer ends of these second levers are connected to vibrating cams that move the high pressure inlet valves, the function of the vibrating cams being to allow the large amount of lost motion that is indispensable in obtaining a quick movement. As the travel of the inlet valves is but one inch, while that of the vibrating cams is twelve inches, a very sharp cut-off results.

The low pressure inlet valves are set to close at 35 inches from the commencement of the stroke. A full sized drawing of the cams that move these valves (not here shown); answers for an example. The other cams are similarly constructed. It will be observed that the disc part of the cam is attached to a center that is keyed to the cam shaft. These centers have a T shaped groove, into which the bolt heads that secure the discs are fitted. This construction allows any amount of adjustment that can be desired, as will readily be seen.

The hand gear consists of a pair of small steam cylinders, which turn a crank shaft that can be connected at will with the cam shaft by a clutch, the axes of the two shafts being in the same line. The miter gear on the cam shaft also has a clutch, which is connected to the clutch on the small crank shaft, in such a manner that it must be thrown out of gear before the other can be put in gear, and *vice versa*.

The eccentrics for working the valves of the small cylinders are placed on a separate shaft which is turned by a hand wheel. The eccentrics give motion to levers which are pivoted to other levers that receive motion from the pistons. A differential motion is thus imparted to the valves, with the result that the engines will stop immediately when the hand wheel ceases to turn, because the motion imparted by the levers connected with the pistons will close the valves.

The main framing of the engine is formed by four massive columns, which are secured to the bed plate, and have suitable flanged facings at their upper ends, to which the feet of the cylinders are bolted. These columns also form the cross-head guides.

The bed plate is in four pieces—two sides and two ends—the back end forming the air pump and channel way.

The jaws for the crank shaft and beam pedestal boxes are cast in the side pieces of the bedplate, all the journals being situated in the same horizontal plane. The gross weight of the bedplate is 65 tons, each side piece weighing 21 tons.

The running gear of the engine, with the exception of the beam and crank throws, is of steel. The piston rods are respectively 6¾″ and 7″ diam. The cross heads, L. P. link, connecting rod, main center, crank pin and shafts, were made by Krupp, of Essen, and are beautiful work. The L. P. link and the connecting rod are of a peculiar construction, as will be seen in engraving, Fig. 1. A jaw is formed for the boxes by cutting in from the side. A binder is then fitted so as to hold the jaw from opening or closing, and the adjustment of the boxes is effected by a wedge, which is drawn up by a screw and nut; two set screws bearing against the upper edge of the wedge hold it solid. The boxes are also held solid by set screws in their flanges.

The beam, or perhaps the term rocker would be more appropriate (see Fig. 1), consists of a pair of gun iron wheels, 11 ft. in diameter, with the pins for piston and crank connections forced into their rims. The main center is 18 inches diameter on the body, and 15 inches diameter in the journals, which are 30 inches long.

A heavy counterbalance casting is bolted to the bottom of the beam wheels, its weight being adjusted so as to equilibriate all the vibrating parts. This is a matter of importance, as these weights aggregate upwards of 25 tons, and make 120 vibrations per minute.

The crank shaft is 18 inches diameter in the journals and 45 ft. long, over all, the journals having a length of 32 inches.

The crank pin journal also is 18 inches diameter, and has a length of 24 inches.

The crank throws are made of the best charcoal scrap iron, and weigh 4 tons each.

The total weight of the shaft is nearly 30 tons.

The air pump is horizontal and double acting, 30 inches diameter and 30 inches stroke; it is worked by an arm on the end of the main center. It is of the plunger

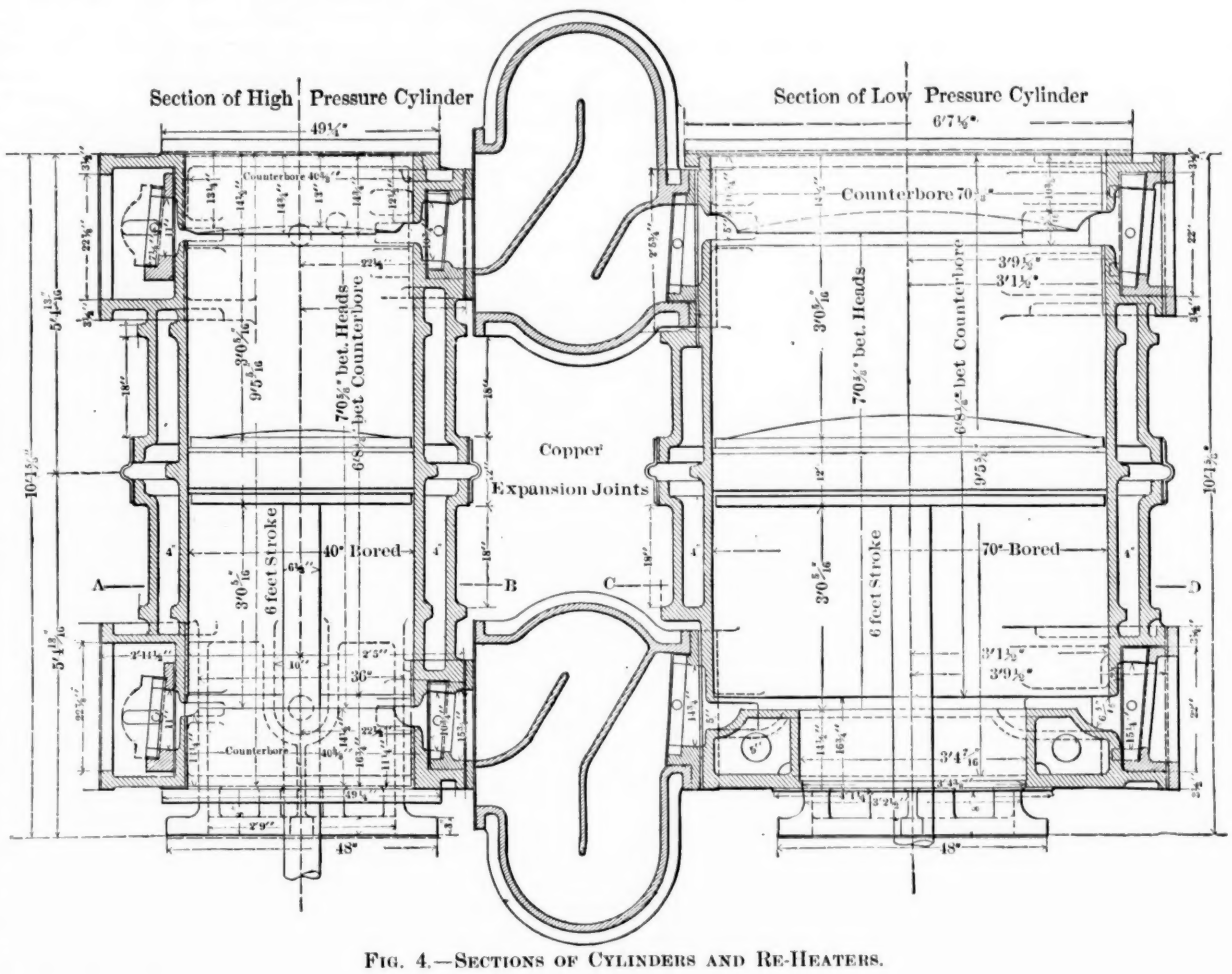


FIG. 4.—SECTIONS OF CYLINDERS AND RE-HEATERS.

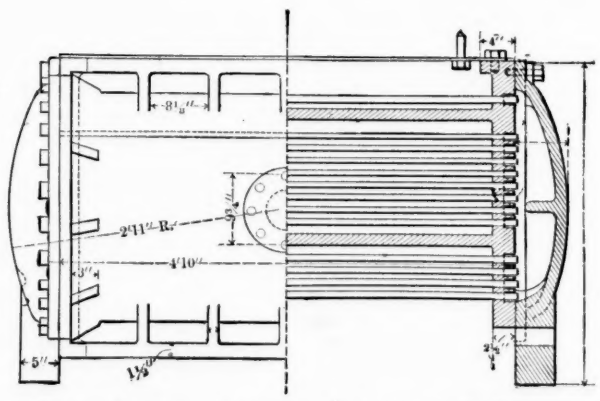
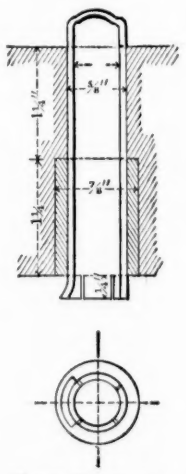


FIG. 6.—LONGITUDINAL HALF SECTION OF RE-HEATER.



TUBE PACKING.

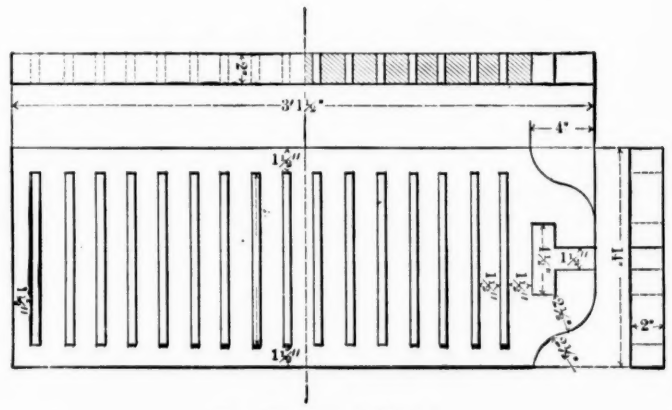


FIG. 7.—SLIDE VALVE.

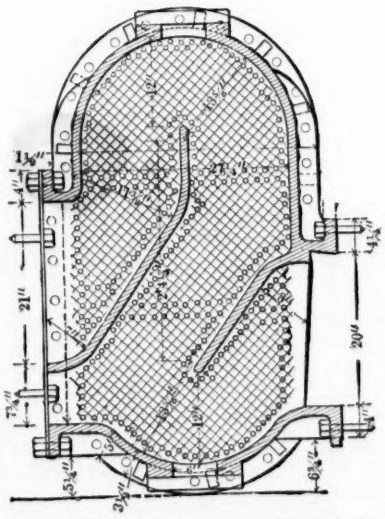
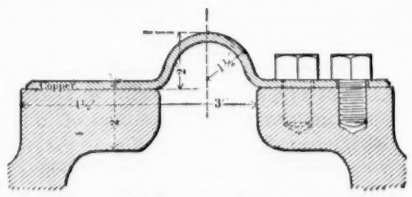


FIG. 5.—CROSS SECTION OF RE-HEATER.



EXPANSION JOINT.

construction, and has water packing. The valves are of rubber, and have iron grids for seats.

There are two pulley fly wheels, each 32 ft. in diameter, 32 inches face, and weighing 45 tons. Each consists of a center and twelve segments, an arm and a segment being cast together. As a precaution to resist danger from centrifugal force, the rim has twenty-four wrought iron braces 3″x1″, in section for securing it to the center.

Each pulley will carry a 30-inch treble belt, which will have to transmit a maximum of 600 H. P., to be distributed by wire rope transmissions over a length of 2,000 ft.

One end of the crank shaft will be coupled to the pinion shaft that drives the hoisting drums, and the other end to a pinion shaft for driving two pairs of 32″x48″ air compressors.

All the shafting is made of steel, and varies from 12 to 18 inches diameter, being proportioned to transmit with entire safety the maximum power of the engine, which is estimated at 4,700 horse power when working with six expansions. It is hardly necessary to remark that such an amount of power is not likely to be called for very shortly.

The foundations are constructed of brick and stone masonry. They are 40 ft. long, 18 ft. wide and 18 ft. deep above the pocket holes (for bolts). They rest upon rock bottom.

For supplying steam to the "Superior," there will be five locomotive boilers, containing in the aggregate 260 square feet of grate, and 11,000 square feet of fire surface.

The dimensions of the boilers are as follows:

Length, extreme.....33′ 4 13/16″
Breadth of fire box at bottom..... 9′ 2⅛″
Height " " extreme..... 8′ 9/16″
Inside diameter of barrel..... 7′

Each boiler has two furnaces, 8′ long, 4′ wide, and 5′–6¼″ high, above base ring; back of each furnace is a combustion chamber, 2′ 11″ long, extending into the barrel of the boiler, where the two unite in a single chamber, 4′ 1″ long, up to the front tube sheet.

There are 118 iron tubes, 3½″ diameter outside, and 18′ long between tube sheets.

All the plating is of the best quality of open hearth steel, varying from 5/16″ in thickness, as used in the furnaces, to 9/16″ in thickness, for the circular shell.

All the joints of the barrel are butts, with outside and inside straps; and are double riveted throughout.

The staying is proportioned for a working pressure of 135 lbs. per square inch. The crown sheets are hung by bolts to wrought iron arches, which are riveted to the roof of the boiler; and the bolts are so arranged that a man can pass the entire length of the crowns, and examine every part. Access can also be had to the barrel, below the tubes, for its entire length.

The boilers are supported by a cast iron ash pit, at the furnace end, and three cast iron cradles under the barrel; the cradles rest on iron balls, so as to move freely, to accommodate the expansion.

There is no brick setting; to prevent radiation, there is careful clothing with non-conductors.

Each pair of boilers will have a flue heater for the feed water. These heaters are composed of brass tubes, 2½″ inside diameter, having several hundred square feet of exposed surface. By this method, the water enters the boilers at 140° and upwards.

The main steam pipe is of wrought iron tubing, 12″ diameter, and about 75 ft. long. It discharges into a receiver near the engine, which is 5 ft. in diam., and 15 feet high. A short pipe, 12″ diameter, connects the receiver with the H. P. cylinder.

It is expected that the "Superior," with three of its boilers, will be completed the present season.

In conclusion, the writer desires to put on record the fact that the creation of the plant, to which the "Superior" forms the latest and greatest addition, is due to Prof. Alexander Agassiz, the president of the Calumet and Hecla Mine, whose forecast and sagacity as a man of affairs are only equaled by his skill as a scientist. An engineer by profession, he has the great advantage of being able to grasp engineering details, and thus fully comprehends what is often lost sight of—the axiom, that the best is the cheapest.

Compound and Automatic Cut-off Engines.

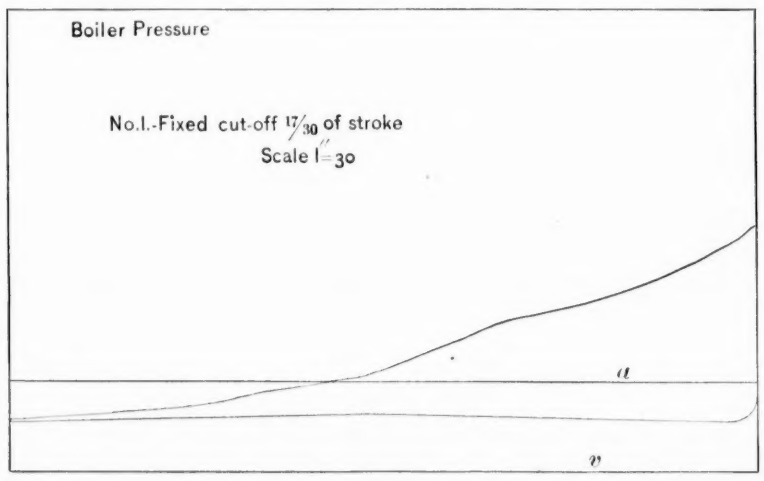
BY F. F. HEMENWAY.

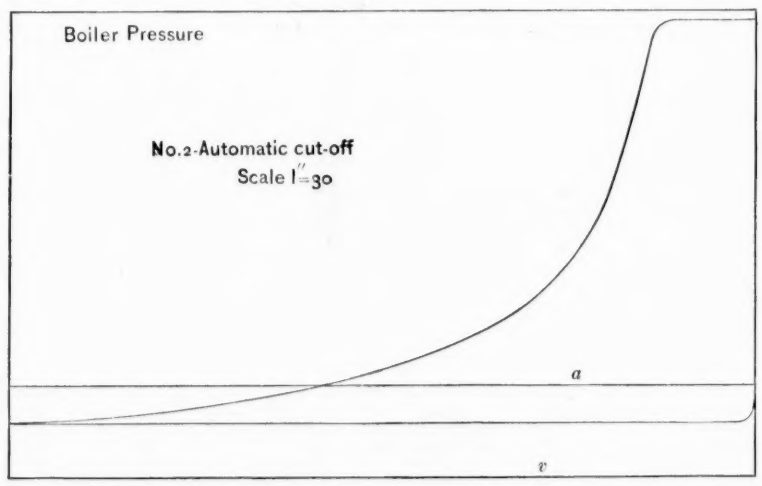
The AMERICAN MACHINIST's correspondent, Mr. Beach, [see issue of May 28th] is doing what a good many of us are doing—looking for light on the steam engine question. It seems more than probable from his communication, that he is able to shed light, in which case he ought to speak right out. If a man asks questions on that subject he won't find much difficulty in puzzling a good many. He has seen a compound engine with a fixed cut-off on both cylinders, working with boiler pressure equal to 55 lbs. or 60 lbs., and with a pressure in the receiver of 5 lbs. or 6 lbs. less than that of the atmosphere, notwithstanding the cut-off on high-pressure cylinder was considerably later than half stroke. This, I suppose, is another expression of the fact that the steam was a good deal throttled between the boiler and engine, and that, strictly speaking, there was no high-pressure cylinder in use at the time, and does not of itself indicate anything wrong with the engines. Compound engines are about like any others, and those who build them are, no more than the builders of other engines, exempt from having to furnish one quite too large for the average work, in order to provide for occasional or periodical increase of load. Had Mr. Beach extended his observations, perhaps he would have found that upon some days, or at some times in the day, this engine would have been working under very different conditions of load, and presumably at much better economy. I presume, from his description, the engines were coupled nearly at right angles, with high-pressure cylinder exhausting into a receiver, or something that served the purpose of one. Whether, in the particular case cited, an automatic cut-off would add to the economy or not, is—like most of the problems in steam engineering—only to be settled by actual trial. When the world gets a great deal wiser on the subject, and when the collective knowledge of individuals gets reduced to a science, we may, any of us, be able to demonstrate mathematically any problem in which steam is a factor. In the instance cited by Mr. Beach, with an automatic cut-off the steam would have been expanded to a still lower terminal pressure in the high pressure cylinder; or, to put it another way, *apparently* more work would have been done in the high pressure cylinder with the same quantity of steam. The theory, if there is any theory about it, of the automatic engine is, that since there is, theoretically and practically, a gain in the use of steam of a high pressure, it is best to use it as near the boiler pressure as possible, instead of throttling it to a lower pressure before use.

From Mr. Beach's description, and from some little experience, I should expect a diagram from the high pressure cylinder very much like that shown in No. 1; in which the point of cut-off cannot be determined by the indicator. With an automatic cut-off, and accounting for the same quantity of steam, the diagram would have been similar to the one shown in No. 2; from which it will be seen that there is an *apparent* gain in the high pressure cylinder of 60 per cent. In both instances, the boiler pressure is supposed to be 60 pounds gauge pressure. This demonstrates the *possibilities* of higher pressure, and, incidentally, the value of the automatic cut-off in permitting its use; the throttling governor being neither more nor less than a reducing valve in the steam pipe, which, by its operation, prohibits the use of steam at high pressure; notwithstanding, it may be at hand. In reference to one-quarter stroke being the most economical point of cut off, there are a great many, besides the writer referred to, who believe there is no economy in cutting off any earlier in the stroke than that point; but the bare statement of the fact without explanation is misleading; perhaps not to engineers, but it is to many who have an interest in such matters. It should be qualified by saying that, at ordinary pressures, where an earlier cut-off is brought about by the use of steam of higher pressure, there is always, or generally, a gain. It wouldn't be correct to say this gain resulted from an earlier cut-off. It results from the use of steam of higher pressure. To make this clearer: In an automatic engine working under boiler pressure of, say, 50 pounds, and loaded so as to cut off at one-quarter stroke, corresponding to a terminal pressure of about 16 pounds absolute, which is quite too low for a non-condensing engine; if the load remains the same, and the boiler pressure be increased to 70, the cut-off will adjust itself to cut off materially shorter, which may be taken as a loss; the terminal pressure will fall below the atmosphere—another loss, and yet the general result will be a material gain. This gain comes from the fact that the automatic engine is ready at all times to take all the advantage there is in increased pressure, and this increased pressure results in better economy, but not because it admits of further expansion. It does it in spite of too much expansion.

To demonstrate this it is only necessary to maintain the pressure and increase the load until the cut-off is again at one-quarter stroke, when a still further gain will be found. If there are facts, and experience leads me not to doubt them, they clearly demonstrate why in any steam engine working under variable load and boiler pressure, the fixed cut-off cannot be adjusted to work with the same economy as the automatic cut-off. This, and the fact that as compared with the cylinder of the fixed cut-off engine in which an attempt is made to get—economically speaking—the best results, the cylinder of the automatic engine may generally be about 25 per cent. smaller, seems to me to account for what I believe to be the higher economy of the automatic.

The most unfortunate thing there is about the automatic engine is its name—unfortunate because it has brought about more misunderstanding in reference to its functions than anything else. It has brought about the construction of engines to work at unreasonable expansion, and, has constantly led people to expect something miraculous from a little earlier cut-off, when the fact is that within the limits of quite a wide range the gain or loss from more or less expansion is very slight. This loss or gain within this range is insignificant compared with the loss or gain from the use of steam of low or high pressure. Had the automatic cut-off stationary engine been called the boiler pressure engine, it wouldn't have sounded quite as well perhaps, but there would have been something in the name that would have suggested its distinctive economical feature rather than the mechanical peculiarity of its operations. Something that would have started individual thought in the right direction and led up to a better understanding of it. Sometimes it uses up a good deal of the endeavors of the intelligent engineer to satisfy the proprietor that it is the thing to carry 75lbs. steam when 50lbs. will do his work.





A Portable Threshing Engine.

The engraving presented on page 5 represents a new style of portable engine intended principally for agricultural purposes, such as driving threshing machines, saws, or other machinery. It has a vertical tubular boiler and engine, which arrangement requires much less space than a horizontal boiler and engine. The smoke stack is hinged so that it may be lowered out of the way when not in use. The engine is provided with a governor heater and pump The whole is strongly mounted upon an iron frame supported by iron wheels of large size, which enables the machine to be moved more easily from place to place. This engine is well built, compact, and is claimed to be economical in operation. It is built by the Wheeler & Melick Company, Albany, N. Y.

Ransom Cook, who lived for 80 years in Saratoga County, N. Y., and died recently, was said to be proficient in 26 trades, and owner of 17 patents. In devising what is known and used extensively as "Cook's bit," or boring auger, the inventor was making a machine, and wanted an auger that would bore at an angle with the grain, without starting with a gouge. He hit on the idea of examining the lips of the worm com-

monly known as the wood-borer, with a microscope, and from this model, furnished by nature, he made his auger, which was very successful.

LETTERS FROM PRACTICAL MEN.

Locomotive Boilers.

Editor American Machinist:

Taking all the various shapes and forms in which steam boilers are made, both for land and marine use, I think none are regarded more safe than locomotive boilers. This, no doubt, can be accounted for in the fact that the highest order of talent is employed in their construction, as well as in their operation and management.

On entering a country saw mill or manufactory of any kind where steam is used, we instinctively look around for the steam gauge, and, if found verging toward 100 lbs., we cannot help feeling a little nervous. When we board a steamboat, we look around for the inspector's certificate, and request a room as far as possible from the boilers.

But thousands of people pass to and fro in our great depots unmindful of the snorting "iron horse," and, if they notice it at all, it is only to admire its beautiful proportions, and to contemplate its wonderful powers. This may be accounted for in the fact that so few locomotive boilers explode, compared with the great number in daily use. On the morning of the 28th ult. we were forcibly reminded, when this city was shaken for miles around, that such explosions do occur. A large freight engine, just ready to start with its train, burst its boiler with fearful effect, throwing its fragments in every direction. One of them, weighing nine pounds, buried itself in the body of a man at a distance of half a mile, while the engineer, at work under the tender at the time, was but slightly injured. The latter tells us there was but 147 lbs. of steam by the gauge but a minute before, when he left the cab. The valves were set to blow off at 150 lbs., and that all the gauges showed water. It is not my purpose to offer any theory in explanation of this, but from observations taken about this wreck and three others it has been my chance to witness, I will draw some conclusions as to the strong and weak places in such boilers. In all of these explosions the fire box and part of shell attached suffered but little injury. Most of the flues also retained their position, holding the smoke head in position. In every case the cylindrical shell was torn in fragments, and thrown almost entirely away. This shell, then, would seem to be the weak portion and the first to give way. Then we have evidences that go to show that the rupture begins at the longitudinal seams. The shell, it is plain to see, may be made of heavier iron and the seam double riveted, which tests show to be 20 per cent. stronger than single riveting. But even this double row of rivets leaves the seam much the weakest place.

It has always seemed a little strange that the same care should not be taken in joining boiler plates, that is used in joining iron in other cases where great strain is to be sustained.

Who would think of connecting stretcher bars in bridge work by lapping, as in Fig. 1?

The very nature of the case renders it necessary to make a connection, as shown in Fig. 2. Why not adopt this method in joining boiler sheets, as shown in Fig. 3?

The row of rivets at A may be placed at intervals of three to four inches, and serve the purpose intended.

I think experiment would show this method of making a joint at least 20 per cent. stronger than the double row of rivets commonly used. Boilers will continue to explode so long as they are used. But necessary caution would prevent many such calamities. QUIRK.

Chattanooga, Tenn.

Shortening The Hours of Labor.

Editor American Machinist:

In your timely editorial in issue of June 11th of the AMERICAN MACHINIST, headed, "A Sign of the Times," you did valuable service in defence of a good cause—that of "shortening the hours of labor." Surely, those who create the material wealth of the country have a right to participate in its blessings, and it is only fair that those who build labor saving machinery should have a percentage of the time thus economized. That some employers should stubbornly butt against so small and reasonable a concession as five hours weekly is rather remarkable, since they are intelligent men and well know that when the short time system once becomes established, it will not work to their detriment. Your argument, drawn from statistics, that 9 hours might produce as much work as 10, could be supplemented by the testimony of one, at least, of our oldest Brooklyn manufacturing machinists, who found it expedient to put his men on three-quarter time during the late depression of trade, but on its revival was reluctant to resume full time again, because "he had been getting as much work out of his men in eight hours as he expected to get in ten." From this it appears that the human machine is capable of just a certain amount of strain which develops the same quantity of work, whether he labors eight hours or ten hours.

That employers in the various branches of the machinists' trade are well able to grant this boon of five hours per week, is proved by the fact that while many of them manfully conceded it, hardly any have refused on the score of inability.

Having taken the subject in hand, I am sorry you did not discuss more fully the Saturday-half-holiday phase of the movement, which, in the opinion of a great many, is, beyond question, the better shape for the 55-hour system, both for employers and employes. An hour each day would merely amount to so much rest, but would afford no opportunity for study or useful recreation. By taking the five hours in a lump on a Saturday afternoon, the mechanic gets more value out of the time, whether he employs it in study, or takes himself away ten or fifty miles from the city for a change of air. Perhaps the strongest argument in favor of a free Saturday afternoon, is the fact that when it was established in the United Kingdom, the average age of a machinist was but 33 years. *Since then it has gradually crept up to* 41 *years*, as proved by the yearly reports of the Amalgamated Society of Engineers and Machinists. This is something to place to the credit side of the trade union account. ARTISAN.

Brooklyn, N. Y.

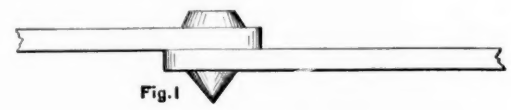


Fig. 1

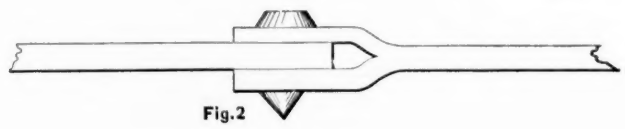


Fig. 2

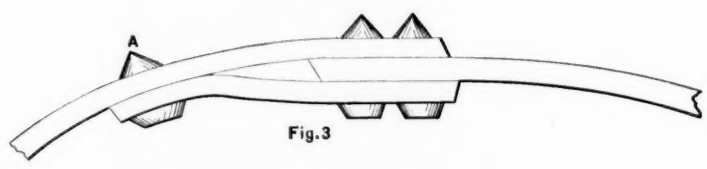


Fig. 3

Steam Gauges and Safety Valves.

Editor American Machinist:

Under the head of "Boiler Management," I think it well to speak of the steam gauge and safety valve, two important adjuncts to the steam boiler. The safety valve should be *known* to be in good working order at *all* times, or it is not a *safety* attachment at all. It is rather a dangerous fixture, for if the engineer relies upon it to relieve the boiler when set at a certain pressure and it does not act, an explosion may occur at any moment, especially if the boiler is old and weak.

To insure the good condition of the safety valve, it should be eased from its seat several times during each week. It should be kept free from accumulation of dirt, and on the slightest sign of leakage, ground in the first time steam is let down. It is a too common practice amongst engineers when they find their safety valve leaking, to hang extra weights on the lever. This is a bad practice. A few minutes' grinding when the valve shows signs of leaking, will put it in good condition. Many engineers pin their faith too closely to their steam gauges, seeming to think the safety valve is but a fixture to complete the outline of the top of the boiler. I know of an instance where a brick arch over a boiler settled down on the lever of the safety valve so hard, that it bent the lever. The engineer was not aware of this fact. A friend calling to see him one Sunday when he was repairing things, happened to glance up at the arch, and called his attention to the bent appearance of the lever. Now, suppose the steam gauge had got out of order about the same time, and indicated a low pressure. The engineer would have urged his fire under the boiler, and the consequences would have been an explosion, and the Coroner's verdict, which (if correctly rendered) would read: "Died from his own carelessness."

A case occurs to my mind where the engineer kept his safety valve in good order and gave it daily inspection. When he came to the works in the morning, the fireman said to him: "The safety valve is blowing, and I have but 25 pounds of steam." The valve had always blown when the gauge indicated 60 pounds.

Here was a difference of 35 pounds. The engineer knew at once the gauge was at fault. It had indicated correctly the day before. He examined the pipe leading to the gauge, and found it partly stopped with mud and sediment. The pipe was but $\frac{1}{4}$" gas pipe. I would advise larger pipe for a steam gauge, $\frac{3}{8}$" at least. It should be blown out occasionally, and should be put up so that it is convenient to do so. The engineer should satisfy himself that the pipe is always clear. He should have his steam gauge tested occasionally, and when found accurate he should compare the safety valve with the steam gauge, at intervals, to see if they agree, by causing the valve to blow slightly by gradually raising the pressure in the boiler. One will act as a check upon the other. Steam gauges are not infallible, and sometimes deceive.

I give below a rule for calculating a safety valve, which may be of service to your young readers.

Multiply the area of valve by the pressure per square inch. Then multiply this product by the distance of valve from fulcrum. Multiply the weight of lever by half its length. Multiply the weight of valve and stem by the distance from the fulcrum. Add the last two products together, and subtract from first result. Divide the remainder by length of lever. The product is the required weight to be hung on end of lever.

St. Louis, Mo. ENGINEER.

A PORTABLE THRESHING ENGINE.—See page 4.

Western River Steamboats.

Editor American Machinist:

The writer of a somewhat humorous communication on the above subject, in a late issue, is evidently an Eastern man, and as such totally incompetent to comprehend our system of navigating rivers of great length, but with very little water. It is doubtful if any Eastern man ever did understand it. Even your artists cannot give a correct delineation of our river steamers. These are expressly intended to carry as much cargo as possible on what water there is in summer, which is seldom more than two feet, and do it as safely, cheaply and promptly, as possible.

Having been familiar with these boats since 1834, perhaps this brief description may interest your readers:

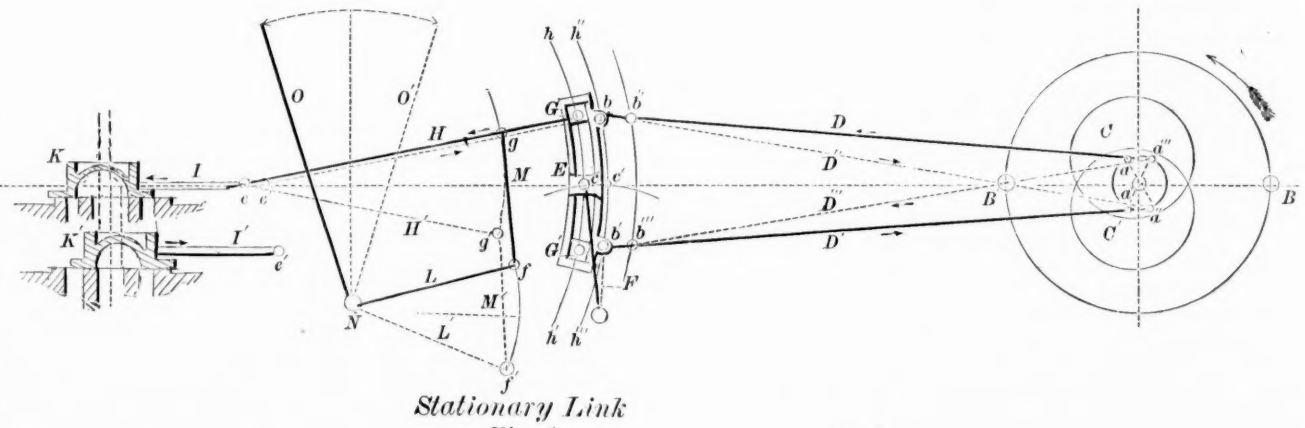
Instead of being "paste-board" boats (though built as lightly as possible), they withstand the storms, sand bars, snags and hurricanes among very wild currents for 15 to 20 years. Those built for the lower Mississippi and Missouri River trades have to be particularly staunch, strong and powerful.

They are of two sorts, stern wheel and side wheel—the former now largely predominating, especially on the smaller rivers. Of course, it would be impossible to run machinery that would "go up or down a couple of feet." The facts are that the engines are never out of line at all, except through unusual causes, neither are the hulls, which are usually well stayed below by strong compartment trusses running fore and aft, and above with heavy "hog chain" rods, running both ways athwartships, and fore and aft.

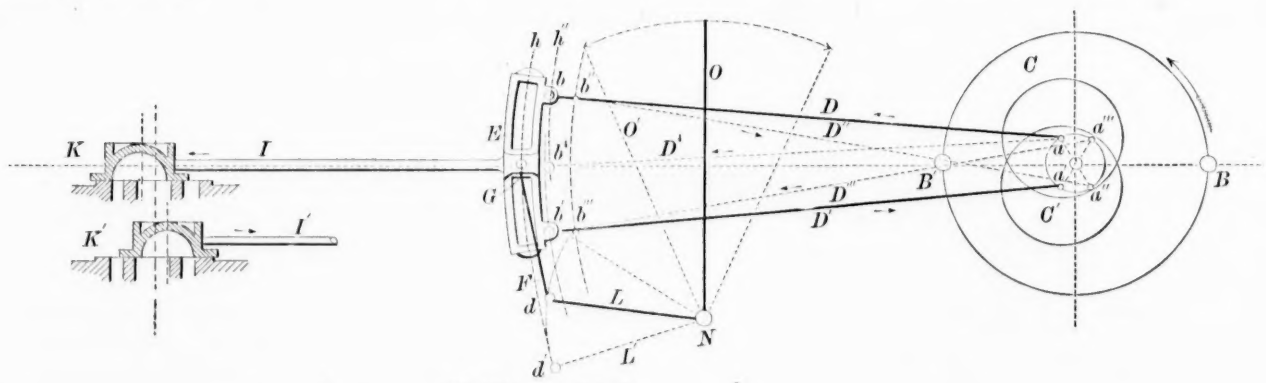
The boilers are placed forward on a side wheeler, and the two engines, one to each wheel, are amidships. Two heavy timbers run clear across the hull, between which the wheels are placed, well stayed with heavy iron rods, above and across the vessel, with gallows frames outside to steady the wheels, which cannot possibly sag or sink "up or down," unless the timbers and chains both give way.

The cylinder timbers are very heavy and bolted as firmly as possible to the hull. One of these, next the wheel, extends full length to the crank shaft journal, which it supports. The other is not more than half as long. The pitmans or connecting rods are long, usually 15 to 20 feet; made of wood to lighten, and well strengthened with gibs, keys, etc., to get all the power from a long stroke engine to a slow moving wheel. The latter seldom revolves more than 15 times a minute, and usually not as often. As the crank shaft journals are on the same timber with the cylinder, all bolted down as solid as bolts can make them, it is difficult to see how they can get out of line at all. They seldom do, except by uncommon accident.

In stern wheel boats the weight is better distributed and the draught usually less, by placing the boilers forward and the engines and wheel at the stern. Two heavy timbers are run out at each side, a little farther than the center of the wheel, which revolves between them. These timbers are, of course, strongly bolted below to the hull, and stayed above with heavy iron rods, which run fore and aft, and also athwartships, which brace against arched trusses in the hold, to stiffen everything as much as possible. Two engines are used, one on each side, at the end of the wheel shaft to which they are attached, the timbers being long enough to support the cylinder at the inner end, and the wheel, shaft, cranks, etc., at the outer end. As a rule these cannot get out of line. If they did, from any cause, the boat would instantly be stopped till all was made right again.



Stationary Link
Fig. 1.



Shifting Link
Fig. 2.

As to high steam, of course a high pressure boat carries higher steam than a low pressure boat. But for the past 30 years many useful and some very annoying regulations have been passed by Congress and the Treasury Department. As a rule locomotives now carry much higher steam than Western steamboats. Your correspondent must have been looking through the bottom of a glass at the bar of the Effie Afton, if he saw 225 lbs., or much more than half that pressure, by any correct gauge. Boilers are tested by hydraulic pressure to 200 lbs.

All sorts of engines have been tried on these waters. In 1832, the boats had but one big slide valve, hemp packed, as your correspondent states. In the cylinder of one of these boats the writer easily sat upright. Then, two engines were used, as now, with a relief poppet lever on top of the slide valve chest, which did not amount to much. But the engine finally adopted, with 4 lever poppets, an inlet and exhaust at each end, was a great improvement, though it took a strong "striker" to keep her from "locking and getting in irons." At present the steamboat engine has 5 cylinders, a large one, horizontal, and 4 for vertical poppet valves, having levers at each side on the corners. The engine well balanced now, and works with comparative ease and promptness, though very slowly. It would soon be knocked to pieces if compelled to make anything like 100 turns a minute. It is by no means an economical device, but directly the contrary. Still, it answers the purpose.

No steamer was ever pushed or walked on stilts over a sand bar in the mode described in your paper. They generally get aground by striking one side of the channel, when they must be pushed and sparred over sideways into it. This is done by using two spars on the same side, one holding while the other is being set anew. Formerly this was done by deck hand capstan power, but in more recent years donkey and nigger engines are largely used, with excellent effect. No boat of any size could possibly be grasshoppered along, as your correspondent suggests; though numbers of them carry good freights on 15 inches of water.

The following is a brief description of one of the latest and best styles of side wheel steamers of light draft on the Ohio River:

She is 302 feet long, 43½ feet beam, with 6 feet hold, carrying 1,000 tons freight besides fuel and 200 cabin passengers, on about two feet of water. There are four steel boilers, each 30 feet long, 47 inches diameter, and having six flues. Two horizontal, high pressure, lever poppet valve engines are used, 25 inch cylinders and 8 feet stroke. The side wheels are located about 98 ft. from the stern. All the cargo is carried on the main deck, the trips being short, while the hold is utilized for fuel, by which the steamer is trimmed when needed. The speed up stream averages 12 miles an hour.

Mark Twain passes for a funny writer who is largely indebted to his imagination for his facts, though he spins a readable yarn, with barely truth enough to answer for salt in it. Yet once he was a Western river man, sure enough.

The old steamboat men were a brave, honest, generous, rough, hard-swearing, drinking set of men. They risked their own lives and property as freely as they did those of others, when they got excited and ran slow races, making high steam with bacon, resin and plenty of whiskey.

But they are nearly all gone. Steamboating is played out, and they have no successors. The writer recently traveled all day on the Mississippi river without meeting another boat. The big rivers are comparatively silent and deserted now. Rafts, steamers and all, only about 45 boats a month (less than 25 each way), passed through the Mississippi canal last year—the canal that cost the government so many millions of dollars to build. Railroads and annoying legal restrictions are destroying the navigation of the great rivers, which is now not one-fourth what it was thirty years ago, notwithstanding the cackling over an occasional tug and barge fleet from St. Louis to New Orleans.

OLD GREASER.

Out West, June, 1881.

Ready Reference Book.

Editor American Machinist:

Everyone will, I think, find a "Ready Reference Book" a means of saving much time, and probably of accomplishing an end which might be gained in no other way.

The next best thing to having an unlimited stock of information in your head, is to know where to find it readily outside of that best place.

Not a week goes by in which there is not an article in some one of the many valuable papers of the day, which at some particular time in a man's life would prove of great service to him.

If a note book be kept with headings, such as "Machinery of Transmission," "Holding Devices," etc., and reference be made to whatever papers may be accessible, either through libraries, friends, or one's own, and the title, together with the name of paper, author, and date be placed in its proper place, you will in time have in this book a concentrated library.

As a general thing, no one man can afford to take a great number of papers; and even if he should do so, it is a question whether he would have time to read them all.

But, by this system of indexing, a person may know immediately where to go for the best information upon any particular subject which may present itself.

For example: I am interested in indicators, and at a glance at the book see that I may obtain information from

AMERICAN MACHINIST, May 8, 1880.
" " " 7, 1881.
Van Nostrand, February, 1874.
Journal Franklin Institute, etc.

By devoting one hour a week to this, one may soon have in possession a book of much value.

JES. H. PADDOCK.

Wilkesbarre, Pa.

Preserving Drawings for Use.

Editor American Machinist:

Since Chordal's bolt has caused so much talk and brought out so many different draftsmen's ideas, and so many machinists have poured out their theories, perhaps one more drop would not overflow the subject.

S. W. Powel, in your June 14th number, has this statement:

"I have yet to meet a good draftsman who believes that drawings should be kept in rolls or rolled, in any way." Again, speaking of workingmen "learning their trade in shops where machinery is built from models or patterns, such as cotton and woolen machinery," he says: "Drawings are rarely seen by machinists in these shops."

Having been associated with cotton and woolen machinery builders for several years past, I must contest his statement somewhat. Many parts of cotton and woolen machinery are built from models or patterns, which is certainly as correct a plan of securing a perfect duplicate as has been found. I can point with pride to some of the best practical constructions, and some of the best machinists' drawings in this or any other country, among the many specimens of each found in the drawing rooms of our American cotton and woolen machinery makers. I do not mean by this, draftsmen who can show diplomas of a scientific or technical school, and who have memorized the methods of its professors, but draftsmen who have worked their way up from apprentice boys, using the gifts given them by the Creator, and diligent study after shop hours, either in the mercantile and public library or by their own candle light, until each is considered competent to take possession of a drafting-room, and apply his mind wholly to the work of constructing. Many points are gained by such a party by experience that are of great value and convenience.

Most if not all of these draftsmen have drawings of machinery of very large size, and knowing that a machine does not show to so good advantage when reduced in size, make full sized drawings when possible. A drawing 72" square, cannot be laid flat; and the detail parts of the same may be on two sheets, 15"x30", and 15" square. These, of course, can be placed in a drawer.

The plan adopted by myself is as follows: First, as my drawings are of so many varied sizes, I use XX Manilla, 54" wide. This will damp, stretch in good shape, and will bear a great amount of fatigue.

After the drawing is completed, I cut it up carefully and attach a tag to one corner. Should it be a drawing of large size, and liable to be used to any extent, the drawing is bound on the edges with a band of the same paper; on being rolled it becomes a close compact parcel, which can be readily found by the number on the tag. The full name of the drawing is also printed on the outside. When placed in a rack according to its length, it can be taken down for examination without the trouble of thumbing over several drawers full, and having to turn up every drawing before discovering that it was the bottom one in the last drawer. Should the drawing be 15" long in the roll, it will bear the letter corresponding to that length, and the first unused number. Thus, if it is a coupling, by looking in your index book you find under *C*, "Coupling for small shaft," *H* 15.

Proceeding to your rack you find readily *H* 15 on the tag, and you are satisfied. This rack must of course be protected by curtains or doors, to exclude the dust.

Worcester, Mass. DIVIDERS.

Does the Conservation of Force Conserve?

Editor American Machinist:

It would appear from the article of Mr. Clemens, in your issue of June 11th, that he and Mr. Porter are in doubt about it. Now, as I am constructing a motor whose principles of operation are based upon the above law, and by which I propose to divide the mechanical equivalent of a unit of heat between the motor and the unit, or, in other words, go halves with the unit, you can imagine my horror of the thought that this law may be overturned. You, Mr. Editor, who ought to know everything, must prevent this, or I shall be tempted to sue for damages.

It may be presumption upon my part to advise you how to do this, but I will be responsible if you say that any force which is arrested within or by a magnetic field takes the electro-motive form. Perhaps, with this clue, Mr. Porter and Mr. Clemens may find the equivalent of the heat which they have lost in raising the weight.

JOHN F. ALLEN.

Link-Motions of the Slide Valve.

BY MELVILLE CLEMENS.

The function of the "link" in valve gearing, is to reverse the engine's motion and to vary the degree of expansion of the steam, by governing the points and periods of its admission and release to and from the cylinders of the steam engine.

It is delicate in its operations, being materially affected by slight modifications, especially in regard to the mode of suspending it and the arrangement of its attaching joints and connections in the valve gearing.

In all valve motions a good link gear should produce through the valve, free admission and release of the steam, equally well for both the front and the back stroke of the piston, and be adjustable for such varied degree of steam expansion as will enable efficient use of the steam power, in all its positions.

Link motions, as used to operate slide valves, are of two classes or systems, known as the "*stationary link*" and the "*shifting link.*" The stationary link is supported or suspended on a fixed point, and connected direct to the crank shaft eccentric-rods; reversing the engine and the variable steam expansion is produced through it, by shifting up and down in the link, the "sliding block" of the valve rod or rocker arm. In the shifting link the link itself is shifted up and down on the block, to reverse the engine and to vary the steam admission and release.

Without entering fully into the elaborate series of diagrams and investigations, which are necessary for a thorough study of link motions, the two systems of link motions may be shown by simple comparative diagrams and descriptions, making the subject readily comprehended in a general way, advantageously to those who may not have become familiar with it.

The diagram Fig. 1, on page 6, is an illustration of the stationary link motion, and Fig. 2 of the shifting link motion.

In Fig. 1, A, is the center of the crank and eccentric shaft of a steam engine, AB, and AB', are, respectively, the crank positions at the commencement of the forward and back strokes of the piston. C, and C' are the fore and back eccentrics, which have their respectives centers at a and a' when the crank pin is at B, and at a'' and a''' when the crank is at $B.'$

The fore and back eccentric rods are, respectively, at D, and $D,'$ when the crank is at B, and at D'' and $D,'''$ when the crank is at B'. E, is the link "open" and "coupled behind," at b, and b', to the eccentric rods D, and D', and supported at its center e, by the sustaining link F, on the transverse rock shaft d. The link is curved to the radius of the radius link $H.$, and the radius link block G, slides in the curved groove of the link, moving from G to G', as the radius link is moved from H to H'.

The reversing link M is pivoted at one end, g, to the radius link H, and, at its other end, at f, to the reversing lever L, fast on the rock shsft N, operated by the hand lever O. The radius link H is pivoted at e to the valve rod I, of the valve K. The valve is shown at K, in its position over the steam and exhaust ports of the engine cylinder, when the crank is at B, at the commencement of the forward stroke; and the valve is also shown at K', in its position at the commencement of the back stroke, when the crank is at B'.

It will be seen that by swinging the hand lever from the position O to the position O' that the reversing lever L takes the position L'; reversing link M takes the position M'; radius link H takes the position H'; and that the block G takes the position G'.

Now when the block G is at the upper end of the link, or at "full gear forward," the valve will be governed in its travel by the fore rod D, as if it were driven by the single eccentric C; and the valve will distribute steam to the engine cylinder, so as to drive the engine forward. But when the block is shifted to the lower end G' of the link, or in "full gear back," it will, in like manner, be governed in its travel by the lower or "back" eccentric rod D' and back eccentric C', and the engine will run backwards. When the block is at c, the middle of the link, or at "mid gear," its travel will be governed equally by the fore and back rods and eccentrics, it having, in that position, about one-half the travel which it has when in gear at G and G'. When the block is at positions in the link, intermediate between its middle and its ends, its travel will partake more of the motion of the eccentric rod to which it is nearest, operating to run the engine forward when the block is above the middle of the link, and to run it backwards when placed below the middle of the link.

The stationary link gearing is thus adapted to move the valve so as not only to reverse the engine, but to vary the distance of the valve's travel, without varying its lead or linear advance. It is, therefore, evidently adapted for variable expansion, or variable periods of steam admission, suppression and release, for each stroke of the piston.

In setting out the stationary-link motion for any given travel and linear advance of the valve, the eccentrics must be of such diameter, and their angular advance of the crank be such that, taken in connection with the length of the eccentric rods and the link, the horizontal motion of the ends of the link, at points b and b, shall be equal to the travel of the valve when in full gear; and so that the horizontal distance $b\ b''$ or $b'\ b'''$ (representing the linear change of position of the link, as the crank pin is changed from B to B') shall be equal to two times the linear advance of the valve.

In the diagram Fig. 2, illustrating the shifting link motion, the valve and mechanism is, as far as practicable, the same as in Fig. 1, and the same literal references are used, in order to aid in comparison of the two systems of link motion.

The principal distinction in the features of the operation of the two systems is, that in the stationary link the valve has unvarying lead and linear advance; while in the shifting link the valve's lead and angular advance varies with every change of the position of the link.

The diagram shows the sliding block G, fixed on the end of the valve rod I, at "mid-gear" with the link E. The link and eccentric rod joints are in the position b and b' shown in full lines, when the crank is at B, and when the crank is at B' they are at the positions $b''\ b'''$; so that the horizontal distance $b\ b''$ or $b'\ b'''$ is equal to the change in position of the valve and link at those two positions of the crank.

The horizontal motion of the link, due to the eccentrics, is least at the center of the link, at which point it is equal to twice the linear advance of the eccentrics, or the distance $b\ b.''$

The travel of the valve when in full gear, either front or back, is equal to the full throw of the eccentric moving it;—that is, when the link is open at the end to admit the block to move so as to bring the valve rod in line with the fore end of the eccentric rod.

The varying lead of the valve, produced by shifting the link, may be observed by inspection of the diagram. The full lines show the valve in mid gear, with the crank at B, the commencement of the forward stroke. If now the link be shifted down so as to bring the valve in full gear forward, the connecting point b, of the fore eccentric rod and link, will fall at b_4, and the valve be drawn back towards A a distance equal to the horizontal distance of point b_4 from the dotted circle $b\ b'$ (centered at A); thus lessening the lead of the valve by that distance, in changing from mid gear to full gear.

By constructing larger scale diagrams, the varying lead due to shifting the link, may readily be found in a similar way.

The motion of the valve by the stationary and the shifting links and double eccentrics, in substantially the same as that from a single eccentric of variable throw and advance, when the valve gearing is properly proportioned and suspended.

Foreign Technical Notes.

Translated for the AMERICAN MACHINIST.

BEHAVIOR OF METALS IN SOLIDIFYING.

The researches of Herr Kopf, says *Dingler's Polytechn. Journ.*, have shown that phosphorus, sulphur, wax, stearic acid, stearine, chloride of calcium, phosphate of soda, hyposulphate of soda, and Rose's metal grow larger in volume when fused. As to metals; the data of past observations are very discordant, and on this account M. M. Nies and Winkelmann have recently studied the question anew. Their fundamental experiment was putting the solid metal into the fused metal. In some cases the difference of density could be measured. They found, then, that tin in solidifying is increased in volume 0.7 per cent.; zinc is increased 0.2 per cent.; while solid bismuth is as much as 3 per cent. less dense than the fused metal. The fact of expansion in solidifying was also demonstrated for antimony, iron, and copper. With lead and cadmium the results were indecisive; the former presented difficulties in a probably very small difference of density, as a solid and as a liquid, its small heat conductivity and heat of fusion; the latter in the fact that in fusion it passes first into a viscous state. Thus, of the eight metals examined, six showed distinct expansion in solidifying; and the same may occur in the two others. So far as these experiments go, therefore, the phenomenon in question would appear to be the rule, and not the exception, for metals.

NEW MINERS' SAFETY LAMP.

The *Berg. u. Hüttenmann* reports that a certain M. Bauer, of Freiberg, in Saxony, has constructed a new safety lamp. The principle of the contrivance is the substitution of the light of phosphorescence for that of positive ignition, and the apparatus is described as something resembling a tiny meat screen. The interior of this screen is covered with a brightly luminous paint. The great advantage this lamp has, is that it guards against a peril from which the Davy lamp cannot protect the workman, as obviously no risk whatever is run by using a phosphorescent light in mines.

NEW GAS BURNERS AND GAS PRODUCERS.

La Honille says that the attention of the Société des Injinieurs Civils, Paris, has been directed to a series of comparative trials of gas burners, and a paper has been published giving a table, from which it appears that while the ordinary street gas jet—the *bec à papillons*, or bat's wing burners—gives for every 1,000 litres of gas 7.70 to 8.60 units of light; the latest gas burner, that of M. Siemens, of Dresden, for the same quantity of gas exactly, gives 29.00 units of light, being an increase from nearly four to one. The compound burner, used in the Rue du Quatre Septembre, consists of six bat's wing burners, arranged in a circle about 6 inches in diameter; these gave from 9.20, that of Ulbrich & Messurer, which bear a striking resemblance to the well-known Sugg burners, 14.0; the Bengel spheroidal burner, 12.80; the Marini-Goelzer, 10.6 to 11.6; and the Siemens' "Regenerateur," 20.0 to 29.0. In order to raise the heat of the flame and to obviate the cooling action of the inert nitrogen, M. Siemens utilizes the waste heat of the products of combustion by the simple construction of a regenerative apparatus. It appears from the above, that gas is at present in a position four times better to meet the electric light competition than it was. On the other hand, M. Siemens, of London, has constructed a new gas producer, which can be worked in combination with a gas furnace. The solid fuel, such as coal, coke, etc., in the producer is acted on by heated air and steam, by which the fuel is rapidly decomposed; and its carbonaceous and hydrogenous constituents form gases with the constituents of the air and steam, while the earthy constituents drop in a fused condition to the bottom of the producer. This gas, being very rich, regenerators are dispensed with.

Newly Incorporated Companies.

NEW YORK.

The Toppan Insulating Company, New York; Charles Toppan, William C. Joy, and Samuel C. Burrell, incorporators; Capital, $100,000. To manufacture and sell insulated wire and cables for telegraphic, telephonic, and electrical purposes.

Owasco River Railway Company; Directors, C. Wheeler, Jr., H. V. Howland, Wm. H. Seward, John S. Clark, G. W. Allen, John H. Osborn, O. H. Burdick, Wm. A. Kirby, David M. Osborn, B. A. Tuttle, Robert A. Peat, Henry I. Kosters, and Chas. W. Miles; Capital, $30,000. To construct, maintain and operate a railroad, commencing at Junction of N. Y. C. R. R. and Garden St., in the city of Auburn, and extending by most direct and feasible route to foot of Owasco Lake, in the town of Fleming, Cayuga County. Length of road three miles.

The Maxfield Rubber Company, New York; Chas. A. Maxfield, Chauncey T. Bowen, J. Bonton Crosby, Chas. P. Crosby, and others, incorporators; Capital, $100,000. To manufacture and sell soles and heels for boots and shoes, also in sheets, pieces or cakes, to be used on steps or as mats, etc.

Brush Electric Light Company of Buffalo; James Adams, William B. Sirrett, Alford P. Wright, and others, incorporators; Capital, $200,000. To manufacture and sell machines, instruments, apparatus, and equipments necessary for the business of lighting streets, avenues, parks and buildings in the city of Buffalo.

Solar Rubber Company, Eastchester, Westchester County; Geo. H. Thompson, Jno. T. Underhill, and Geo. F. Morris, incorporators; Capital, $100,000. For the manufacture and sale of rubber clothing and rubber goods of all kinds.

The Mayville Extension Railroad Company. Directors: Sabin Colton, Jr., F. J. Kimball, F. S. Kimball, Henry Levis, W. G. Macdowell, J. D. Mitchell, T. Webb, C. E. Kimball, M. Chubb, J. G. Tach, C. C. Pomeroy, H. A. V. Post and H. Blake Tyler; Capital, $50,000. To construct, maintain and operate a railroad commencing at the town of Fairpoint, Chautauqua County, running thence southwesterly to Mayville, where connection is made with the Buffalo, Pittsburgh & Western Railroad Company. Length of road about 3 miles.

Burling Garbage and Ash Box Company, New York; Wm. B. Eddy, J. Sanford Potter, George F. Martens, Wm. A. Boyer and Jesse L. Eddy, incorporators; Capital, $150,000. To manufacture, buy, sell, let, hire, and deal in garbage and ash boxes.

Rochester and Windsor Beach Railway Company. Directors, H. F. Shoemaker, P. P. Dickinson, Wm. Purcell, Geo. H. Thompson, Hosea Rogers, Anson Bronson, James McManus, Wm. H. Creswell, Pierson B. Hulett, Simon Stettheimer, Wm. C. Brush, William Emerson and Bernard W. Tone. Capital, $1,000,000. To construct, maintain and operate a railroad in the County of Monroe, commencing on North St. Paul street, in the city of Rochester, and extending along the bank of the Genesee River to a point near Somerville on the Lake shore, thence easterly along shore of Lake Ontario, to a point at or near Irondequoit Bay.

The Clarke Combination Car Company, New York; George Clarke, Eugene A. Heath, Thomas O'Neil, Richard Vose and John O'Neil, incorporators. Capital, $2,000,000. To manufacture or cause to be manufactured, palace and sleeping cars, and to sell, lease, operate and maintain the same upon railroads in the United States and foreign countries.

The Westchester Railway Company. Directors: Wm. F. Van Pelt, Ernest Hall, Clarence L. Westcott, Chas. B. Hall, J. Thomas Stearns, Harrison E. Garotry, Philip Allen, Samuel J. Young, P. Gardner, W. S. Hoyt, Lewis M. Brown, Frank D. Brown, and Geo. D. Davis, Jr.; Capital, $1,000,000. To construct, maintain, and operate a railroad, beginning at a point on the New York & Harlem Railroad, near the village of White Plains; thence to towns of North Castle and North Salem, N. Y., and Greenwich and Ridgefield, Conn.; thence to the Housatonic Railroad, near Brookfield Station, and through the town of Danbury; also from some point in the city of New York to the several places mentioned in White Plains, at the State Line, Brookfield, and the town of Danbury; also a branch from some point on main road to a point on Long Island Sound, late in Westchester County. Length of roads about 66 miles.

The Continental Electric Light Company, New York and Brooklyn; John Fahnestock, A. J. Severance, and David C. Ferris, incorporators; Capital, $20,000,000. To manufacture and sell machinery, generators, lamps and other appliances for illuminating purposes by means of electricity.

Neptunite Water Repellant Company of New York; Geo. W. Beach, Geo. W. Lockwood, Thomas Sparling, Jr., Robt. S. Forbes, and Peter A. Vincent, incorporators; Capital, $500,000. To manufacture and apply solutions to fabrics, paper, leather, etc., for the purpose of rendering the same water, moth, and insect proof, and to manufacture and operate machinery for the making of such solution, and the treatment of such fabrics, etc.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.

JACKSON BAILEY, Vice-Prest.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

The American News Company,

Publishers' Agents, New York.

The International News Company,

(Formerly the Wilmer & Rogers News Co.)

11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.

Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY

The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis Book and News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh Book and News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, L. I.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Washington News Co., Washington, D. C.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 30c. per line, (12 lines one inch.)
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, JUNE 25, 1881.

CONTENTS.

PAGE.

The Superior. By E. D. Leavitt, Jr.....1, 2, 3, 4
Compound and Automatic Cut-off Engines. By F. F. Hemenway..... 4
A Portable Threshing Engine..... 4
Letters From Practical Men—Locomotive Boilers—Shortening the Hours of Labor—Western River Steamboats—Ready Reference Book—Preserving Drawings for Use—Does the Conservation of Force Conserve?..... 5, 6
Link-Motions of the Slide Valve..... 7
Foreign Technical Notes..... 7
Newly Incorporated Companies.....7, 9
A Saturday Half Holiday for Machinists..... 8
Poorly Trained Locomotive Engineers..... 8
A Machinist's Society..... 8
Literary Notes..... 9
Questions and Answers..... 9
Manufactures..... 9
Machinists' and Engineers' Supplies.....10
Iron and Metal Review.....10

The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

A Saturday Half Holiday for Machinists.

The recent movement of the machinists and other iron workers of New York, Brooklyn and Jersey City to secure a half holiday on Saturdays has proved remarkably successful. It has been conducted with careful consideration of the best interests of both employers and employes, and, while the latter are to receive a great benefit, the former are not expected to suffer any loss in the long run. At the present writing the half holiday seems to be generally conceded by shop proprietors in the three cities; but the question of loss of half a day's pay has yet to be fully settled. A few shops, including some of the largest, have conceded full pay, with 3 P. M. on Saturdays as the hour for closing, and some others have conceded full pay, with a half day's leisure every week. The necessity of a conference of shop owners to discuss the question, and take some uniform action upon it, has been recognized, and one will probably be called before this reaches our readers. Some large Saturday afternoon meetings have been held by the machine shop mechanics, at which speeches were made in favor of the half day recreation; and the movement has received the cordial support of the influential daily and weekly press. In the course of an editorial the *New York Times* says:

To many persons outside the circle of professed philanthropists, who have, occasionally, with sympathy or sadness, given a few moments' thought to the condition of the thousands of their fellow-beings who are confined to the dull and deadening round of twelve hours' work a day for six days in the week, the success of the machinists in their effort to introduce a new and freshening element into their lives will be genuinely gratifying. That speaker at Saturday's meeting who told his fellow-workmen that in reducing their weekly hours of labor from 60 to 54 they had added several years to their lives, was entirely within the bounds of truth. They have not merely gained half a day a week for healthful recreation, they have made life consist of something besides the hours of work and sleep. There must be many among them to whom the privileges of this half holiday, six hours in the week not devoted to money-getting, will be the occasion of an awakening of dormant faculties which will make better men and citizens of them.

It is evident that the writer meant ten hours, instead of twelve hours work a day, and that the "dull and deadening round" is a considerably exaggerated expression, to apply to operations in a live machine shop, however well it may fit the course of work pursued in some other industrial establishments; but the sentiment of the paragraph we quote is the correct one to adhere to. The taking of a Saturday half holiday has been a regular custom in England for several years, and, as noted by one of our correspondents this week, statistics show that the average life of mechanics has been considerably lengthened since that custom was adopted. An interesting feature of this increase of average longevity is that it has gradually gone forward since the hours of labor were shortened. This reason alone would seem to be strong enough to warrant the ready adoption of a universal plan, of suspending work in machine shops half a day every Saturday. As our correspondent remarks: "By taking the five hours in a lump on a Saturday afternoon, the mechanic gets more value out of his time, whether he employs it in study or takes himself away ten or fifty miles from the city for a change of air." It is better also for employers, than a regular reduction of time to 9 hours a day. The cleaning up and repairing of machinery and motive power can best be done during an entire half day's stoppage; besides which there is greater economy in using steam power ten hours a day than nine hours. The improvements in shop equipments likely to be introduced during these Saturday intermissions should largely, if not wholly, make up any loss of production that might otherwise be caused by a five hours' shortening of the weekly working time. Shop proprietors, as well as their workmen, need rest, and would experience a like benefit by closing up as a rule on Saturday afternoons. Neither political economy nor social ethics would suffer any shock by adopting that custom. Its success in New York City and vicinity serves as a beginning to a general acceptance of the weekly half holiday throughout the country.

Poorly Trained Locomotive Engineers.

On many railroads the money value of the locomotive, as a machine, does not seem to be well appreciated, if we may judge by the caliber of some of the men placed in charge, and the treatment locomotives receive from such men. Too many engines, now-a-days, are put in charge of men whose entire qualifications consist in just enough practice as firemen to enable them to start, stop, pull the bell and blow the whistle. Intelligent training, due to careful attention, they have none; round-house training they have none. The intricate and costly machine placed in their charge is run well, so long as it can run itself. Let any accident, or disarrangement, or wear, or want of adjustment arise, and the locomotive either begins to prepare itself for the scrap heap, or it goes to the shop for repairs, that would perhaps have been needless with better handling. Either course is a costly one for any road to follow—much too costly to be counterbalanced by any apparent saving in wages.

The engineer who knows not only how an engine should be run, but, whenever his engine is undergoing repairs in the round house or shop, takes occasion to notice which parts most need repair, how repairs are made, and how engines and boilers are built, is the engineer whose services should be most in demand.

Such information may be obtained by frequently visiting the shops, by reading, and in many other ways that will easily become apparent to those who want to find them out. Men, too, who are willing to inform themselves in these ways are more apt to possess the intelligence, judgment and skill required to complete the qualifications of a reliable and capable locomotive engineer.

An incident was related the other day of a locomotive engineer, who, ran the same locomotive several hours daily for four years without any repairs being needed, owing to the care with which the engine was handled. One day this engineer was promoted to the position of master mechanic of the road. After his promotion, his engine was put in charge of an engineer who ran her very successfully for a considerable time. Finally, a slight pounding somewhere in the engine began to be noticed by the new engineer, but locate the disturbance he could not, though all the time fearful and wondering. One day the master mechanic came along, and took a ride with him. The trained skill of the latter soon discovered that the suspicious noise betokened nothing serious, as it came from above the running board. Manual examination proved the bell frame to be loose; its oscillations, due to the motion of the train, were the cause of the disturbance. This incident shows the value to engineers of having a knowledge of the detail construction of their engines, enabling them to locate difficulties, and render a proper report of the same.

In locomotives, as in other machinery, the value of the investment should never be lost sight of. It may be set down as a safe rule that the time which an observant engineer spends in the round house or shop is well spent, often resulting in avoiding the waste of time and money attendant upon necessary repairs.

The Franklin Institute of Philadelphia has formed a "mechanical engineering section," limited to fifty regular members of the Institute. There can, however, be an unlimited number of honorary members and corresponding members. Prof. Marx, of the University of Pennsylvania, has been chosen President; Mr. Tatum (President of the Institute), Vice President; and Dr. Robert Grimshaw, Secretary. Regular meetings will be held on the fourth Wednesday of every month.

A Machinist's Society.

There is considerable difference in the objects and methods of individual trade unions. Some are founded upon the assumption that every workman in a trade ought to receive as much wages as another, regardless of what he accomplishes. Others are founded for the mutual benefit of their members, in full recognition of the fact that most sensible employers pay for results, rather than for time spent in trying to accomplish them. The men who are able and willing to produce the best results in shortest time will always command the highest wages. Of the latter class of trade unions is the "Amalgamated Society of Engineers, Machinists, Millwrights, Smiths and Pattern Makers," organized in England in 1851, and which has lately gained considerable of a hold in the U. S. and Canada. The object of this society is declared to be, "to raise from time to time, by contributions among the members thereof, funds for the assistance of its members when out of work; for the purpose of mutual support in case of sickness, accident, superannuation, emigration, and for the burial of members and their wives." There is nothing to condemn in such an object. The society is divided into branches, each of which elects its own officers. It is very strong in Great Britain, and disburses a large amount of money annually. In the United States branches have been established at the following places: Allegheny, Pa., Ansonia, Conn., Altoona, Pa., Bloomington, Ill., Boston, Mass., Brooklyn, N. Y., Buffalo, N. Y., Chicago, Ill., Cleveland, O., Detroit, Mich., Dunkirk, N. Y., Elizabethport, N. J., Jersey City, N. J., Milwaukee, Wis., Moberly, Mo., McKeesport, Pa., Nashville, Tenn, New Haven, Conn., Newark, N. J., New Brunswick, N. J., New York City, Omaha, Neb., Paterson, N. J., Philadelphia, Pa. (two), Pittsburgh, Pa., Port Huron, Mich., Port Jervis, N. Y., Providence, R. I., Sacramento, Cal., San Francisco, Cal., St. Louis, Mo., Troy, N. Y., and Worcester, Mass.

In Canada branches have been organized at Hamilton, Kingston, London, Montreal, Stratford and Toronto. There are, besides these, branches about to organize in various other cities and towns, and the membership is very rapidly increasing. A record is kept of all members out of work, and all possible aid furnished them to obtain situations. A weekly allowance is made for members out of work and for those on the sick list; also for those who are superannuated. Monthly reports are printed, giving state of trade, rate of wages, etc., at each point, number of members out of employment, and number on benefit list; also other matters of interest to the different branches. The society does not regulate rates of wages or organize strikes. A minimum rate of wages, however, is registered for each locality, lower than which members are not allowed to engage for, but each is supposed to get as much above the minimum as his services are worth. The lower limit is adopted as a protective measure. The requirements for admission to the society are very strict, and, unless a man is a skilled artisan, and can convince shop owners of the fact, he cannot become a member. They make no regulations to govern the action of shop proprietors in taking apprentices or employing workmen. Regular meetings are held to transact business and for mental improvement by the interchange of ideas. The society has it in its power to do a great deal of good in this country.

The new building of the Massachusetts Charitable Mechanic Society in Boston is ready for the roof. The building will be lighted by electricity during the exhibition in September and October next. Among the things of note to be exhibited will be a complete newspaper printing establishment, stereotyping and all. Manufacturing processes will be shown, and the exhibit of iron and wood working and textile machinery promises to be worth making a long journey to see.

Mr. Leo Daft, electrician of the New York Electric Light Association, estimates that the cost of producing electric light by incandescence is greater than that of producing gas light, in the proportion of 1500 to 992.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1) C. S., Hoboken, N. J., asks: 1. Will you inform me how to find the proper radius for the link for a steam engine? *A.*—Almost every builder of steam engines has a plan of his own for proportioning link motion. We have obtained very satisfactory results by using the following for the radius of the link: Take the distance, with a pair of fine-pointed trams from the center of the driving axle, to the center of the lower rockarm pin when placed in its middle position. The circle drawn with this radius will be the center line of the curve for link. Some builders of locomotives use a greater distance and some less for the radius, but the advantages seem to be only imaginary. 2. Is the lead the same with a link motion when cutting off short as at full stroke? *A.*—No. The lead with a link motion increases as the block moves towards the center of the link. The proportion of increase in the lead is governed by the length of eccentric rods or radius of the link. The shorter the radius the faster will the lead increase, and the longer the radius the less will the lead be affected.

(2) Y. X., Brooklyn, N. Y., asks: How can I lay out the correct form of teeth for a pair of internal gears? The velocity ratio to be 5 to 3, and the diameter or pitch circle of the larger wheel measures 17 inches. I do not wish to use an odontograph, but want a graphical construction which will be theoretically correct; also the proportions for teeth? *A.*—The correct theoretic form can be obtained by rolling a disk, having a diameter 2.25 times the pitch, upon the pitch line of the circle of the wheel, and by inserting a pencil or marking point in the periphery of the disk, and rolling it about 2 inches, the outline of the tooth will be drawn. Multiply the square of the pitch by 550, and the product will be the safe working strain that may be put on the teeth. The thickness of the tooth is usually .45 of the pitch. For the length, allow .4 below the pitch line, and .3 above, and for the breadth, 2.5 times the pitch.

(3) J. A. P., Boston, Mass., asks: 1. Will you inform me what is the pressure per square inch or foot upon a plane submerged in a stream of water and vertical to the current? *A.*—Allow 1 lb. pressure per square inch for every 27½ inches of depth. Owing to the difference in weight of different waters a pressure of 1 lb. is generally allowed for every 2 ft. of depth. 2. Is there any difference in the pressure upon a plane or a concave surface? *A.*—No.

(4) R. A., Janesville, Wis., asks: Will you inform me the best way for polishing out corrugated grooves, about ¼ inch deep and 3-16ths of an inch wide, in castings for fluter or crimping rolls and plates for plating in a battery? I have been using an emery wheel, but find it too expensive for large cast iron surfaces, besides taking too much time to accomplish the work. *A.*—Use a circular cutter and mill, to cut them out; then polish with a first class emery wheel. This will be the cheapest and most expeditious way to accomplish the work. The castings should be of soft iron, and pickled before working which will save time and tools.

(5) M. H. P., Walpole, Mass., asks: 1. What will be the power required to drive a 14-inch fan pump running at 500 revolutions per minute? Said pump has an 8-inch supply pipe discharging through a 4-inch pipe into a reservoir 18 feet above the pump? *A.*—About 3 H.P. when the pump is in first rate order. 2. What will be the power required to drive the same pump when the valve near the pump in the discharge pipe is closed, causing the fan to revolve in dead water? *A.*—This can only be determined accurately by experiment, and is dependent upon the design of, and workmanship displayed in, the manufacture of the pump. If the pump is well made it will not run at all under these conditions. 3. What width of belt will it take to drive the pump, the pulley being 9 inches in diameter; also what is your opinion of the economy of such a pump for raising water? *A.*—A belt 3½ inches wide ought to drive said pump. In reference to economy we would prefer a piston pump for raising water to such a height, as the most economical in the use of power and cost of repairs. If you are running under circumstances where you have an excess of power, and do not require the pump constantly, then there may be economy to use a centrifugal pump.

(6) J. C. D., Steelton, Penn., asks: I would be pleased to learn from some one who has had experience in that line what is the correct speed for a milling tool used in cutting taps and dies, having from 8 to 11½ threads to the inch? Diameter of cutter 1¼, turned to an angle of 60 degrees. *A.*—According to the best practice the speed of your cutter should be about 125 revolutions per minute.

(7) W. A. R. Niles, Mich., asks: Can you tell me how to tin cast iron? I am tinning wrought iron daily, but cannot manage cast—I mean common castings, not malleable. *A.*—First clean the castings thoroughly and smooth the surface to be tinned; then dip them in alcohol, after which sprinkle muriate of ammonia (sal-ammoniac) over the surface to be soldered. The castings should then be held over a charcoal fire till the sal-ammoniac begins to smoke, then dip it into melted tin (not solder). This will tin the surface, which may be soldered in the usual way, and should be done while the castings are warm as the work will be then better performed. If the first dipping does not succeed in covering the surface satisfactorily, the castings should be dipped a second time.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

Dies, Punches and Special Tools, manufactured by H. H. Coles & Co., 446 N. 12th St., Philadelphia.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Steam Engines Indicated and Examined. Power Measured. W. H. Odell, P. O. Box 274, Yonkers, N.Y.

Bound volumes for 1880 of the AMERICAN MACHINIST.—We can furnish Vol. 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. AMERICAN MACHINIST PUBLISHING CO. 69 Fulton Street, New York.

Wanted—Planer, new or good second hand, about 4 ft. x 20 x 20 in. Box 88, Dover, Del.

Wanted to arrange with responsible parties for the manufacture of a New Air Compressor. The best yet designed. John Fish, 8 Pine Street, New York.

Special Notice.—Owners and managers of large establishments throughout the country will find information of positive value in our 75 page illustrated pamphlet, entitled "Useful Information for Steam Users." It contains data on the care and management of Steam Engines and Boilers and Rules for Engineers and Firemen. Sent for 25c. in P. O. Stamps. The J. N. Mills Publishing Co., 165 Broadway, New York City.

Special inducements offered to clubs. "Extracts from Chordal's Letters" in book form, now ready. Cloth. 320 pages. Less than 5 copies, $1.50 by mail, each, postpaid. American Machinist Publishing Co., 96 Fulton Street, New York.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

A New Treatise on Steam Engineering, Physical Properties of Permanent Gases and of Different Kinds of Vapor. By John W. Nystrom, C. E., 8vo., cloth. Price, $1.50, also A New Treatise on the Elements of Mechanics, Establishing Strict Precision in the Meaning of Dynamical Terms. By John W. Nystrom, C. E., 8vo., cloth, price, $2.00, Mailed by E. & F. N. Spon, 446 Broome St., New York City, on receipt of price.

For Sale.—36-inch English Lathe; Screw Cutting and Back Gear, Bed 18 feet, turns 13 feet 25 inches over rest, with power cross feed. Compound Rest, center and follow rests, large and small face plates, extra tool-block for turning, full swing of lathe. New Haven Manufacturing Co. make, but little used, in first class order. Price, F.O.B., Poughkeepsie, $900.00. Sedgwick & Stuart Manufacturing Co., Poughkeepsie, N. Y.

Wanted to arrange with the proper party to manufacture an Automatic Steam Engine on royalty, or would dispose of patents on fair terms. Have patterns for six sizes. Engine equal to the best. Address, Box 15, AMERICAN MACHINIST office, 96 Fulton Street, New York.

MANUFACTURES.

Rome, N. Y., proposes to have a locomotive works.

Ground is being staked out for a new cotton mill at Kaukauna, Wis.

A movement is on foot among capitalists to erect in Cincinnati a mammoth watch factory.

Athol, Mass., has held a meeting to take steps for the establishment of a silk factory in the town.

Silas Brown, Troy, N. Y., is busy on orders for dynamo electric machines for both light and electro plating.

The Albany & Rensselaer Iron and Steel Works are working day and night gangs of machinists on general repairs.

Wm. Sellers & Co., Philadelphia, have 600 men regularly employed. They are changing some of their machine tools and making new patterns.

The new shops of Smith, Vaile & Co., Dayton, O., will start up July 1, furnishing employment to about 150 men.

The Globe Iron Works, of Cleveland, O., are building iron ships, and propose to increase their force to 600 men.

The Lathe & Morse Tool Company, Worcester, Mass., are erecting a fine brick shop near the Junction, for the manufacture of machine tools.

P. Blaisdell & Co., Worcester, Mass., are employing 75 men on machine tools, and could find work for as many more if they had shop room.

Wight & Powell, Worcester, Mass., are about to double the size of their shop room, for the purpose of filling their orders for machine tools. They have brought out a new engine lathe, with some original and valuable features.

David W. Pond, Worcester, Mass., has 250 men at work upon machine tools, and is still making improvements in design.

The machinery manufacturers of Worcester, Mass., would be happy in the highest degree if they had shop room to turn out all the machine tools wanted.

Prentice Bros., Worcester, Mass., have taken a larger shop room, and are making 36 to 40 upright drills and 12 lathes a month, with orders three months ahead.

A. Harris, Son & Co., agricultural implements, Brantford, Ont., are applying for letters patent of incorporation as a company with a capital stock of $250,000.

At Starbuck Iron Works, Troy, N. Y., there is in process of construction a combined car brake and starter for street cars, the invention of Joseph Seeberger, of that city.

W. & L. E. Gurley, Troy, N. Y., are making increased exertions to keep up with orders for mathematical instruments, but so far are considerably behind.

Beecher & Peck, New Haven, Conn., are building a new factory which they will occupy about July 1, for the manufacture of drop forgings and drop presses.

The Moore Hall Foundry and Machine Company, of Phœnixville, Pa., are about to commence the manufacture of drill presses and planers, in addition to their well known line of lathes.—*Iron Age.*

The McCormick Harvesting Machine Co. will shortly build an addition to their foundry. In running their works double turn they now employ 1,400 men and turn out 250 machines daily.

The Greenfield, Mass., Co-operative Cutlery Company will soon occupy the whole of the Power Company's building, increasing the number of their employes, and they expect to nearly double their present production.

William Tolhurst, Troy, N. Y., is several thousand dollars behind his orders for laundry machinery and his other specialties. He has recently added new tools, and has in preparation plans for a new shop which he will erect at once.

William Coutie & Son, Troy, N. Y., have sufficient orders for their compound stationary engine to keep them busy until fall. They have recently placed new tools in their shops, one of which is a 63″ swing lathe.

The erection of a large sugar refinery, to be 160 feet square and 12 stories high, was begun June 6th, at the foot of Polk street, Chicago, Ill. Five hundred workmen will be engaged in its construction.

Haight & Clark have purchased the foundry business formerly carried on by A. Winterburn at Nos. 16 and 18 Detroit street, Albany, N. Y., and will continue the manufacture of small gray iron castings, in addition to machinery and pattern castings.

E. F. Edgecomb, Mechanic Falls, Me., has invented and placed upon the market a new acoustic telephone, the diaphragm of which is so sensitive that the ticking of a clock, twenty feet away from the instrument, can be heard plainly at the other end of the line.

When the new mills and the new machines in the old ones all get running, Holyoke, Mass., will turn out nearly if not quite 150 tons of paper a day, which will include 50 tons of fine or animal sized papers, 50 of engine sized flats and book papers, and 50 of coarser kinds, manilla, news, sheathing, etc.

A two hundred thousand dollar cotton yarn mill is considered a certainty at Pine Bluffs, Arkansas, $100,000 having been already subscribed, and it is believed the balance will be raised at once when the plans for a mill are completed. Quite a number of other mills are talked of. Steam is used for power, and the cotton seed husk is being used for fuel.

Rapid progress is being made at the works of the Allen Paper Car-Wheel Company, located at Morris, Ind., the foundation being nearly completed. The entire structure is being built upon the solid rock, a site having been selected, where, by excavating a few feet, rock of an unknown depth is found.

Whiting Bros. Manufacturing Co., Cedar Rapids, Iowa, write us: "We are completing an addition to our foundry of 40x40 feet, and have in progress of construction an office, a large store room with pattern store room overhead; a japanning oven and blacksmith shop. Our business is increasing steadily and is of a substantial character.

The John P. King Manufacturing Company has been organized in Augusta, Ga., with a capital of $1,000,000, and the privilege of increasing it to $3,000,000. Hon. John P. King is President. The mill will make cotton goods and will be erected on the Knoxville and Augusta Railroad. Over $200,000 have been subscribed in two days.

Knowlson & Kelley, Troy, N. Y., have accepted an order from George Murks for a compound propeller engine with surface condenser. The engines are of the usual inverted cylinder type. This firm have built many single cylinder propeller engines but this is their first compound engine. They are also building a "Pony" locomotive for the Albany & Rensselaer Iron and Steel Works.

The new shop of the Wright Machine Co., Worcester, Mass., is 70x41 feet, and four stories high, with engine and boiler house in addition. They are filling many orders for their new mechanical movement, and have over 2,000 doffer comb ordered ahead. A new steam engine governor and a new elevator are among the articles of their manufacture soon to be placed before the public.

The new Canadian Locomotive and Engine Works Company will immediately commence the erection of a building 324 feet long by 60 feet wide, two stories in height, in Kingston, Canada. The purpose is to have skilled mechanics, first class equipments, and to perform work which cannot be surpassed anywhere. There are sufficient orders on hand to keep the works operated to their fullest capacity until October, by which time fresh contracts will have been obtained. Skilled mechanics—blacksmiths, moulders and machinists—will be in demand.

Newly Incorporated Companies.

PENNSYLVANIA.

Fulton and Washington Railroad Company; Edwin L. McConaughey, Robert M. Janney, Charles D. Barney and others, incorporators; Capital, $1,218,000. To construct a railroad from a point on the Ohio State Line, in Washington Co., Pa., to a point on the Maryland State Line, in Fulton Co., Pa., with a gauge not exceeding 3 feet, a distance of 203 miles. Office, Philadelphia.

Southern Tier Railroad Company; Edwin L. McConaughey, Robert M. Janney, Charles D. Barney and others, incorporators; Capital, $1,248,000. To construct a railroad with a guage not exceeding 3 feet from Waynesboro, Franklin Co., Pa., to West Elizabeth, Allegheny Co., Pa., a distance of 208 miles. Office, Philadelphia.

Fort Pitt Incline Plane Company; Wm. J. Flinn, Harry Moore, S. H. French and others, incorporators; Capital, $10,000. To construct an incline plane railway at Pittsburgh. Office, Pittsburgh.

The Philadelphia Coach Company, Philadelphia; Thomas D. Maurer, 1808 North 11th Street, Wm. D. Kelly, Jr., Hon. Wm. D. Kelly, Philadelphia, and others, incorporators; Capital, $100,000.

Cayuta Forge and Axle Company; Benjamin Maurice, R. A. Packer, of Sayre, Pa., C. S. Maurice, of Athens, Pa., incorporators; Capital, $15,000. Office at Sayre, Bradford Co.

Olean and Coudersport Railroad Company; F. W. Krux, A. G. Olmsted, of Coudersport, Pa., C. S. Cary, Olean, N. Y., and others, incorporators; Capital, $160,000. To construct a railroad with a gauge not exceeding 3 feet, from Coudersport, Potter Co., to a point in Ceres Township, McKean Co., Pa., on the New York State Line, a distance of 22 miles. Office, Coudersport, Potter Co.

The Water Gap and Schuylkill Railroad Company; Abram S. Hewitt, New York City, John B. Storms, Stroudsburg, Pa., Henry Whelan, Philadelphia, and others, incorporators; Capital, $3,000,000. To construct a railroad from Pottsville, Schuylkill Co., Pa., to the New York State Line, at the Water Gap, a distance of 65 miles. Office, Stroudsburg, Monroe Co.

NEW JERSEY.

Bordentown Locomotive Works, Bordentown, N. J.; Thomas M. Tyng, L. L. Spring, Samuel B. Dougherty and others incorporators; Capital stock $400,000. To manufacture and sell locomotive engines and other machinery, etc.

The Richmond & Danville Extension Company, Newark, N. J.; William P. Clyde, George W. Perkins, and Thomas M. Logan and others incorporators; Capital stock, $5,000,000. To construct, improve, and equip railroads, canals, and other works, etc.

CONNECTICUT.

The Bridgeport Cutlery Company, Bridgeport; Fred A. Black, James W. Gray, and John W. Ayres; incorporators; Capital, $15,000. To manufacture and deal in cutlery. Certificates filed.

Tingue Manufacturing Company, Seymour; John H. Tingue, Charles Coupland, *et al.*, incorporators; Capital, $200,000. To manufacture and deal in textile fabrics.

ILLINOIS.

St. Louis and Cairo Railroad Company. Incorporators are—William F. Whitehouse, Lorenzo M. Johnson, S. Corning Judd, Edwin B. Sheldon, Henry B. Whitehouse, James M. Hill and Eugene H. Fishburn, Chicago, Ills.; Casper William Schaaf, Louisville, Ky.; and John B. Lovington, East St. Louis. To construct, purchase, acquire and operate a line of railroad from the City of East St. Louis, Ills., to the City of Cairo, Ills., a distance of one hundred and fifty miles, and to construct a branch road from Columbia in Monroe county to Georgetown in St. Clair county a distance of 13 miles, all in Illinois. Capital stock, $6,500,000. Principal office, Chicago.

Belleville and Centralia Railroad. Incorporators are—Adolphus Meier, Joseph W. Branch, Charles Parsons, St. Louis, Mo.; Marshall W. Weir, Felix Scott, Thomas Knobeloch, John Kloess, Russell Hinckley, Belleville, Ills.; H. W. Hubbard, Centralia. To construct, build and operate a line of railroad from the City of Belleville, St. Clair county to the City of Centralia, in Marion county, all in the State of Illinois. Capital stock, $1,000,000. Principal office, Belleville.

Bemis and Carden Malting Co.; incorporators are H. V. Bemis, John Carden, and Dwight L. Bemis. Capital stock, $50,000. For the manufacture of malt and storage of grain. Location, Chicago.

Union Foundry and Machine Company. Incorporators are Reuben C. Norton, Wm. H. Logue, and Francis E. Roberts; Capital stock, $6,000. For manufacturing and general jobbing. Location, Rockford.

Machinists' and Engineers' Supplies.

NEW YORK, June 9, 1881.

The general state of trade is good, and is not likely to soon decline.

The firm of L. B. Eaton & Rexford, dealers in machinists' supplies, 11 North 6th Street, Philadelphia, has been dissolved, and a limited partnership formed by R. W. Rexford as general partner, and Edward I. H. Howell special partner, to continue the business. The name of the firm is R. W. Rexford. The capital contributed by the special partner is $8,000 cash.

The Worcester Machine Screw Company have issued a complete revised list (as adopted by the Association of Machine Screw Manufacturers) under date of June 1. It will be mailed to any one on application.

Discounts on the machine screw list are as follows: Iron and Steel Set Screws, 60 per cent.; Square-head Cap Screws, 55 per cent.; Hex. Head Cap Screws, 50 per cent.

Dwight Slate, of Hartford, Conn., is about to bring out a new lathe chuck of his own design.

A new and very sensitive steam engine governor is about to be placed before the public by the Wright Machine Co., Worcester Mass.

A new self-feeding ratchet drill has just been brought out by I. N. and R. N Cherry, Jersey City, N. J.

W. B. Dunning, Geneva, N. Y., has issued a postal card price list of 5, 6, and 8 horse power engines built by him. The discount upon list price is 25 per cent.

Iron and Metal Review.

Pig iron remains listless, but not any weaker as regards price. No. 1, $24; No. 2, $22; Gray Forge, $20; Coltness, $23 to $23.50; Eglinton, $21; Carnbroe, $22; Glengarnock, $22.50, and Gartscherrie, $22.50 to $23. The rail market is active. A sale is reported of 10,000 tons steel rails, delivery in 1882, at $56. Iron rails are quoted at $48 to $50 at mill. Old rails are selling somewhat slowly at $26 for T and $27 for double head.

Wrought scrap iron is in light demand at $28 to $30 for selected No. 1 from yard.

Bar Iron from store remains on a basis of 2.5c. for refined. Boiler iron and supplies are quoted as follows: Tank iron, 2¾c. to 3c.; Refined, 3¼c. to 3⅜c.; Shell, 3¼c. to 3¾c.; Flange, 4⅝c. to 4¾c.; Fire Box, 5½c. to 5¾c.; Burden's Rivets, 5 1-10c. Boiler Tubes, 45 per cent. discount from list.

Lake ingot copper is selling in small lots at 18c. The foreign copper market is reported in a bad condition. Tin is getting more active, and sales are made at 20¼c. for Straits, and 20⅜c. for Australian and Billiton. Lead is stronger, but not much more active. Common lead brings 4 1-5c., and refined 4¾c. to 4 4-5c.

The Spelter market is dull at 4¾c. for Western, and 5⅜ for Silesian. Antimony is held at 14c. to 14½c., according to brand.

WANTED

A mechanical engineer and draughtsman of 25 years experience, both in America and Scotland, and who has a moderate amount of capital, will shortly be willing to take a position in a machine shop as partner, or to co-operate in starting a new concern. Address BOX 14, AMERICAN MACHINIST.

Wanted.—Three first-class machinery moulders, accustomed to heavy work. None considered except strictly as above. Good pay and steady work if satisfactory. The Hartford Engineering Co., Hartford, Conn.

A Horizontal Boring Mill, 36 in. Swing, 12 ft. 10 in. bed. Weight, 10,000 lbs. Latest design, extra heavy, workmanship guaranteed first-class, for sale. Address Ohl & Co., East Newark, N. J.

A Swede, 30 years, tecnologically educated, with several years' experience in shops and drawing office, desires a situation as draughtsman. Answer "Swede," 107 Main St., Hartford, Conn.

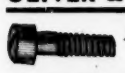
An engineer, experienced and thoroughly competent, wants responsible position. Address, R. M. Lodge, Honeybrook, Pa.

FOR SALE CHEAP.

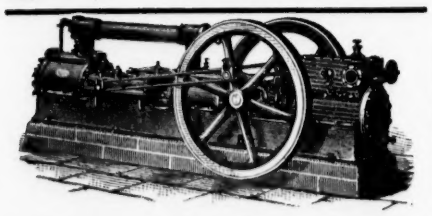
Foundry, Machine, Blacksmith and Wood Shops, with paterns, tools and machinery complete. Will be sold separately or as a whole. Address

F. M. ROBINSON, Conneautville, Pa

Taper holding Lathe Dogs, Patterns, Models, Magicians' Apparatus, &c. OLIVER & SONS, 33 Park Row, N. Y.



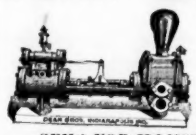
A. B. CURTIS, Machine Screws, West Brattleboro, Vt.



STEAM PUMPS, AIR COMPRESSORS, Friction Hoisting Engines, Vacuum Pumps and Condensers, General Machinery, Steam Engines. Capacity to bore cylinders 110 in. diameter, and turn Fly Wheels of 24 feet.

The Norwalk Iron Works Co.
SOUTH NORWALK CONN.

DEAN BROTHERS,



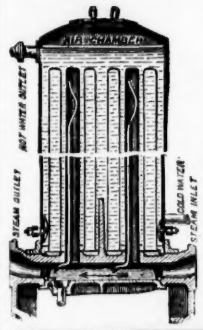
Steam Pump Works,
INDIANAPOLIS, IND.
Manufacturers of
Boiler Feeders,
Fire Pumps and Pumping Machinery for all purposes.
SEND FOR ILLUSTRATED CATALOGUE.

FOR SALE,
AT MIDDLETOWN, CONNECTICUT,

A valuable manufacturing property with water power, machine shops, foundry, forge shop, office, store houses, etc., one dwelling house, barn, and 2½ acres of land. Said premises are within 20 minutes walk of the post office and depot. For particulars, enquire E. ACKLEY, Esq., Middletown, or of E. G. PARKHURST, of the Pratt & Whitney Co., Hartford, Conn.

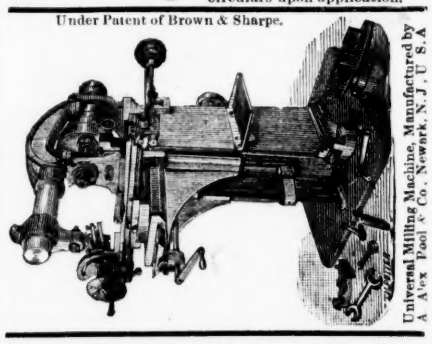
P. BLAISDELL & CO.
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

CHARLES E. ASHCROFT,



235 Franklin Street,
BOSTON, MASS.
Patent Feed Water Heaters, &c.
NON-CORROSIVE POP SAFETY VALVES.
Sole licensee of
Morse and Cockburn Patents.
Sole importer of famous Tomey "EUREKA" Gauge Glasses.
Send for Treatise upon Utilization of Exhaust Steam as means of Heating Feed Water for Steam Boilers. Other circulars upon application.

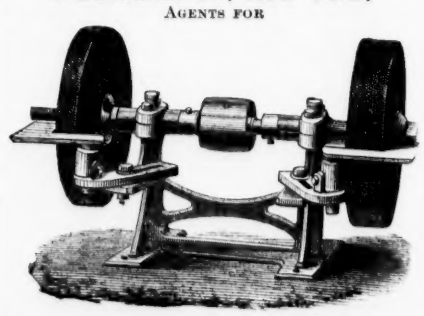
Under Patent of Brown & Sharpe.



Universal Milling Machine, Manufactured by A. Arx, Pool & Co., Newark, N. J., U. S. A.

WOOD, JENNISON & CO.
(Successors to the Wood & Light Machine Co.)
WORCESTER, MASS.
Manufacturers of
PULLEYS AND SHAFTING,
Also, WOOD'S AUTOMATIC BOLT CUTTER.

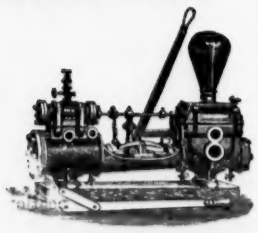
COOKE & CO.
(Formerly Wm. Cooke, successor to Cooke & Beggs)
6 Cortlandt St., New York,
AGENTS FOR



The Lehigh Valley Emery Wheels and Emery Wheel Machinery.
Our wheels possess superior cutting qualities, combined with great durability. Eureka Plow, Polisher and Patent Stove Plate Grinders.

LEHIGH VALLEY EMERY WHEEL CO.
LEHIGHTON, PA.
Manufacturers of Emery and Corundum Wheels and Grinding Machinery.
COOKE & CO., 6 CORTLANDT ST., NEW YORK AGENTS.

Knowles' Improved Steam Pumps,



THE STANDARD!
Steam Pumps for Every Possible Service.
SEND FOR ILLUSTRATED CATALOGUE.
KNOWLES STEAM PUMP WORKS,
86 Liberty Street, NEW YORK. | 44 Washington Street, BOSTON.

KEARNEY & FOOT

Office, 101 Chambers St., N. Y. | Full Weight Hand-Cut Files. | Manufactory, PATERSON, N. J.

The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonials. Read them.

NORTH RIVER IRON WORKS.

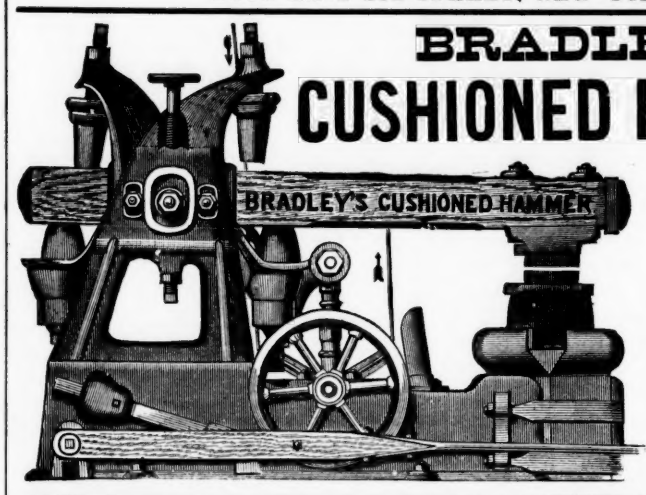
TO WHOM IT MAY CONCERN: New York, May 1st, 1877.
We have used the Files made and re-cut by Messrs. WEINMANN & KEARNEY for the past three years, and we know of no better recommendation than the fact that we are still using them.
FLETCHER, HARRISON & CO.

WINCHESTER REPEATING ARMS CO.

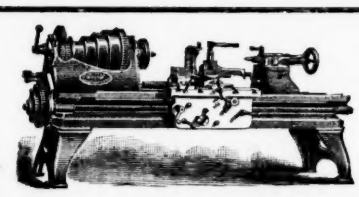
Messrs. KEARNEY & FOOT, New York, New Haven, Conn., Nov. 1st, 1878.
Dear Sirs:—The Files you have been furnishing this Company have proved equal, if not superior, to any heretofore used. Yours truly, V. A. KING, Sup't.

We print on card board 10 x 12 in. "Instructions on the use of Files," which are intended for shop use. These instructions with our "Illustrated Catalogue of Files" we mail on receipt of 27 cents postage. To customers we mail a complete set free of charge. KEARNEY & FOOT.

The Cameron Mining Pump,
Designed for use in Gold, Silver, Coal and Iron Mines. Also for general Manufacturing and Fire purposes.
Pumps furnished with movable linings in iron, composition or Phosphor Bronze.
THE A. S. CAMERON STEAM PUMP WORKS,
FOOT EAST 23d STREET, NEW YORK.



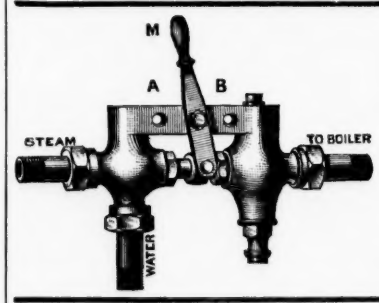
BRADLEY'S
CUSHIONED HAMMER
STANDS TO-DAY
WITHOUT AN EQUAL.
It approaches nearer the action of the smith's arm than any hammer in the world.
Bradley & Company,
SYRACUSE, N. Y.
[Established 1832.]



New Haven Manf'g Co.
NEW HAVEN, CONN.
Iron-Working Machinery,
PLANERS, SHAPERS, DRILLS.

T. NEW'S PREPARED
ROOFING.
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.

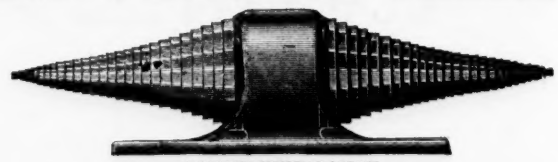
WHITCOMB MF'G CO.
Formerly C. Whitcomb & Co
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.
IRON PLANERS
A Specialty.



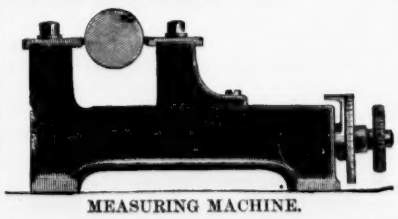
RUE'S
Little Giant Injector,
For Stationary, Marine and other Boilers.
SIMPLE, DURABLE & EFFECTIVE.
Ejectors for Lifting and Forcing Fluids.
Also, Valves of all descriptions.
SEND FOR CIRCULAR.
RUE MFG. CO., 523 Cherry St., Philadelphia, Pa.

BETTS MACHINE CO., WILMINGTON, DEL.
MANUFACTURERS OF
STANDARD GAUGES,
MEASURING MACHINES & ADJUSTABLE REAMERS.

STANDARD GAUGE.
Any size from ¼ in to 6 in.



CORRECTIVE GAUGE.
The disks are ground separately. Any combination of sizes can be made.



MEASURING MACHINE.
Sizes, 0 to 4 in., 0 to 12 in., 0 to 24 in. Can indicate to 1/10000 of an inch.

ADJUSTABLE REAMER.
Any size from ½ in. to 2½ in.
Size Maintained by Blade Adjustment.
Will Outlast the Solid Reamer.
Shank Ground to Standard Size.

KEEP SIZES RIGHT and thus CHEAPEN PRODUCTION.
SEND FOR CIRCULAR.